THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XVIII. No. 436—21st YEAR.] LONDON, JULY 6, 1869. [Subscription per Ann. { 15s. in Advance / 18s. Credit.] DOUBLE No. Price 1s.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—
10,000 cubic feet of gas per ton of coal.
26-candle gas.
13¼ cwt. coke per ton of coal.
RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.
GAS-RETORTS, introduced 1828.
FIRE-BRICK WORKS, established 1804.
FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire Clay.
The Fire Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article.
The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the works are the most extensive in the Kingdom.
Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubitt Town. Large stocks kept.
Address G. H. RAMSAY, NEWCASTLE-ON-TYNE.

GEORGE GLOVER & CO.,
Patentees of the Standard Gasometers for the Government, and of the
IMPROVED DRY GAS-METERS.
These Meters are warranted to measure correctly and not to vary, and have come into general use more rapidly than any Meters hitherto manufactured.

PARIS EXHIBITION, 1867.
THE TESTING-HOUSE REPORTS.
The Reports prepared for the Science and Art Department, under the direction of the Lords of the Council, detail the arrangements made for testing the gas apparatus exhibited. In the testing-house erected by the Special Committee appointed to further this object a gasholder was constructed by Mr. G. Glover, being a *fac simile* of that produced and patented by him in 1860, and deposited in the Exchequer, under the provisions of the Sales of Gas Act, and British manufacturers of gas apparatus were invited by advertisement, and by direct application, to forward worthy objects for exhibition. Mr. G. Glover was, however, the only manufacturer who sent Meters to be tested. The report states that, as "Mr. Glover is a manufacturer of Dry Meters only, no opportunity presented itself of comparing their accuracy with that of Wet Meters under various circumstances, but the perfection to which that maker has brought his Meters prevents the possibility of those extravagant errors which are well known to exist where Wet Meters are used."
Particulars and lists of prices forwarded on application to Ranelagh Works, Ranelagh Road, Pimlico, LONDON, S.W.; 15, Market Street, MANCHESTER; or 97, Boulevard de Magenta, PARIS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS RETORTS and OTHER OBJECTS in FIRE-CLAY," and they have also been awarded in the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire-Bricks, and every other article in Fire-Clay are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Coal Office,
QUAY SIDE, NEWCASTLE-ON-TYNE.

FIRST PRIZE IN THE PARIS EXHIBITION.
JOHN RUSSELL AND CO.,
THE OLD TUBE WORKS,
CHURCH HILL, WEDNESBURY;
ALMA WORKS,
WALSALL, STAFFORDSHIRE;
and 69, UPPER THAMES STREET, LONDON,
Original Manufacturers of Wrought-Iron Gas Tubes and Holders of the present Patents; Inventors and First Makers of LAP-WELDED FLUES for Steam Boilers.
J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water, and the largest Orders may be executed in a few days.
Gun Metal, and all other kinds of Cocks, Stocks, Dies, and Taps, Galvanised Tubes, &c.
N.B. All Goods thoroughly Tested before sent out, and Warranted.

JOHN BENT & SON,
WET AND DRY GAS-METER
AND
STREET-LAMP
MANUFACTURERS,
BELL BARN ROAD, BIRMINGHAM.
ESTABLISHED 1830.
All materials found for the alteration of Public Lamps for lighting with the Rod. Regulators with Lava Burners.

BLAYDON BURN AND LOW BENWELL FIRE-CLAY RETORT AND FIRE-BRICK WORKS,
NEAR NEWCASTLE-ON-TYNE.
WILLIAM COCHRAN CARR begs most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other articles in Fire-Clay, executed on the shortest notice, and on the most reasonable terms.
London Agents: JAMES LAWRIE & CO.,
63, OLD BROAD STREET, CITY, LONDON.

THE "LOTHIAN" CANNEL COALS.
These Cannels are extensively used in the Gas-Works of Edinburgh, where the illuminating power of the gas is the highest in Britain.
The yield per ton is 12,573 cubic feet; illuminating power 33·8 standard candles; coke per ton 1046 lbs.
Ports of Shipment, in the Firth of Forth.

BO'NESS CANNEL COALS.—This Cannel is largely used in gas-works where, in addition to high illuminating power, there exists a demand for superior Coke, it being the best Coke-producing Cannel of all Scottish Cannels. It yields about 11,000 cubic ft. of 25 standard candle gas per ton.
Ports of Shipment, either the Forth or the Clyde.
Apply to J. and W. ROMANES, 53, Frederick Street, EDINBURGH; & 1, Walbrook, Mansion House, LONDON.

NOTICE.
LESMAHAGO GAS OR CANNEL COAL.
JAMES FERGUSON & CO., Auchinheath COLLIERY, LESMAHAGO, and the NITSHILL & LESMAHAGO COAL COMPANY, AUCHINHEATH AND SOUTHFIELD COLLIERIES, LESMAHAGO, sole Proprietors and Producers of the above celebrated GAS COAL, beg to intimate to Gas Companies and other consumers that, having reason to suspect that Cannel or other Coal of very inferior quality, both as regards the quantity and illuminating power of the Gas, has frequently been mixed with and sold under the name of "Lesmahago," they have now appointed Messrs. JAMES LAWRIE & Co., of 63, Old Broad Street, LONDON, E.C., sole agents for England; and Messrs. LA COUR & WATSON, of LEITH, sole agents for foreign markets; and, in order to prevent a recurrence of the frauds named, they request that all purchasers will send their orders through the above-named firms. Orders for other than the above-named markets may be forwarded direct to either of the Proprietors.
The Proprietors will, in future, use their own forms of bills of lading, and also issue certificates of origin, signed, as the case may be, either by JAMES FERGUSON & Co., or by the NITSHILL & LESMAHAGO COAL COMPANY; and they request all consumers purchasing Lesmahago Coal to demand such a certificate for each cargo, and to observe that it corresponds with the bill of lading.
Auchinheath, Lesmahago, March, 1868.

MEDAL AWARDED, EXHIBITION, 1862, "FOR GOOD WORK."
THE IMPERIAL TUBE COMPANY, BIRMINGHAM,
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS, BRASS & COPPER TUBES,
GALVANIZED & GLASS ENAMELLED TUBES & FITTINGS,
LAP-WELDED IRON & BRASS BOILER-TUBES, ETC., ETC.
☞ Sole Makers of "HUGHES'S PATENT TAPS," Strongly recommended for all High-pressure purposes.—Price List and Testimonials forwarded on application.

CROLL'S DRY GAS-METER,
PRIZE MEDALS. (INVENTED & PATENTED IN 1844,) PRIZE MEDALS.
LONDON, 1851; NEW YORK, 1853; PARIS, 1855.
COMBINING ALL THE LATEST IMPROVEMENTS,
LONDON, 1862; DUBLIN, 1865; PARIS, 1867.
MANUFACTURED ONLY BY
THE GAS-METER COMPANY, LIMITED.
238, KINGSLAND ROAD, LONDON, N.E.
A. ANGUS CROLL, C.E., Chairman. GEORGE RAIT, Managing Director.

HENRY HOWARD & CO.,

COOMBS WOOD PATENT TUBE-WORKS,

OLD HILL, near DUDLEY,

MANUFACTURERS OF

PATENT WELDED WROUGHT-IRON TUBES & FITTINGS,

FOR GAS, STEAM, & WATER, EITHER BLACK, GALVANIZED, OR ENAMELLED.

CORE BARS for IRONFOUNDERS, STOCKS, TAPS, & DIES, IRON COCKS, &c.

London Agents { W. G. DAVIS, 2, Brabant Court, Philpot Lane, E.C.
J. R. HILL, 73, Hatton Garden, E.C.

JOHN HALL & CO.,

STOURBRIDGE,

MANUFACTURERS of FIRE-BRICKS, LUMPS, & TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short notice.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS

For Gas, Steam, Water, &c.

SOLE LICENSEES for the United Kingdom for the LAVENANT PATENT ENAMELLED TUBES & FITTINGS,

the Coating of which does not shell off, is a certain preservative from rust, and resists all effects of expansion and contraction.

LAP-WELDED IRON & HOMOGENEOUS METAL TUBES

For Locomotive, Marine, and Stationary Boilers.

Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools of all kinds.

London Offices: No. 4, Cloak Lane, Queen Street, E.C.

WAREHOUSES:

LONDON: No. 157, Upper Thames Street, E.C. LIVERPOOL: No. 4, Cooper's Row, and 3, Crooked Lane, Strand Street.
MANCHESTER: Barlow's Croft, Chapel Street, Salford. PARIS and LILLE.

BEST AND HOLDEN'S

PATENTS FOR CHARGING AND DRAWING GAS-RETORTS,

WITH CHAMBERS FOR MOUTHS,

REQUIRING NO LUTING.

Gas Engineers are solicited to examine into the merits of this invention before erecting new or altering old retort-houses. It may be seen in action at the Alliance Gas Company's Works, Dublin, where its utility and economy will be clearly demonstrated. Although the saving in labour will be considerable, and quickly return any outlay of capital, there are other and important features strongly recommending its adoption at all gas-works, and which a gas engineer upon examination will at once appreciate.

The Directors of the Alliance Gas Company have kindly consented to give every facility to gentlemen desirous of seeing the invention in operation. Parties, therefore, about to visit Dublin will be so good as to send us their card, and we will furnish them with letters of introduction.

Drawings, &c., may be seen at our Office, and all details explained.

JOHN CHISHOLM, SON, & CO., 44, MARK LANE, E.C.

1862.

PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

CLASS II.

This Paint having been in general use over seven years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

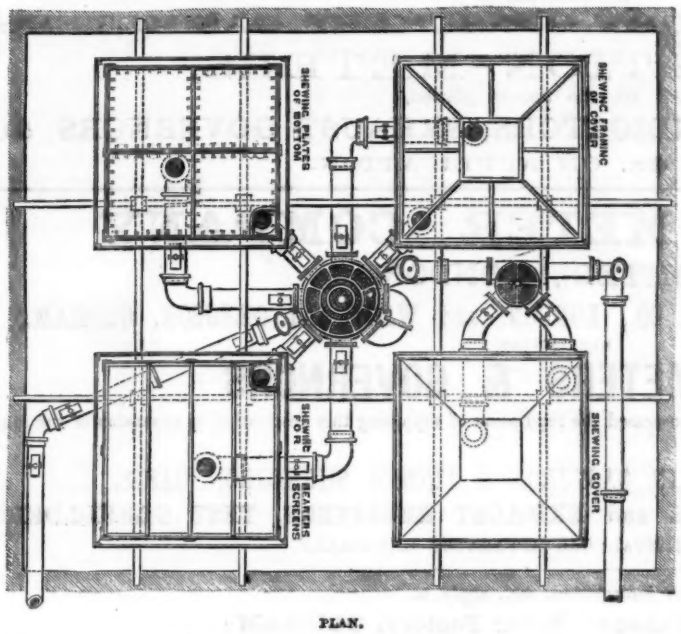
Reference is kindly permitted by the Engineers of the City of London, Commercial, London, and Surrey Consumers Gas Companies, who pronounce it the best Paint known for their purposes.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints, for which purpose it is superior to White Lead.

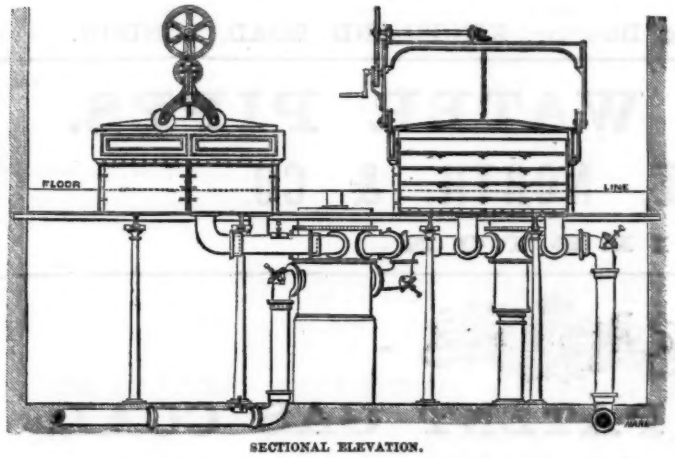
A PLAN & ELEVATION OF GAS PURIFIERS

WITH

COCKEY'S PATENT VALVES.



PLAN.



SECTIONAL ELEVATION.

DESCRIPTION OF PURIFIER ARRANGEMENT.

The plan shows four Purifiers: three of them are worked in rotation by means of a central Valve, so that two are always in use, and the third always out of use for cleaning. By another arrangement of the Valve, either one, two, or three Purifiers may be used together.

The fourth Purifier is used as a guard, with a separate Valve, and is useful in preventing any slightly impure gas, which may have escaped in turning the central Valve, passing in that state to the gasholder.

This system has been found to work well in many gas-works, and in addition to the advantage before stated, it affords a ready and convenient mode of using oxide and lime together for purifying.

By the introduction of a bye-pass, the system is made more perfect, inasmuch as the central Valve, with its connected Purifiers, may be shut off for repair, and the gas passed temporarily direct to the fourth Purifier.

The Valves which are here introduced have now been in use for more than ten years, and have been tested in sizes varying from 3-inch to 16-inch. The increasing demand for them is the best proof which can be given of their satisfactory working and general usefulness.

More than 350 of them have been fixed. They are suited for various parts of gas apparatus, and are especially available for bye-pass connexions. They are also introduced with much advantage for the inlet and outlet connexions of gasholders, and simplify very much the changes where more than one gasholder is in use.

They are durable and easily reground without removal from their connexions, and in a few hours they may be made as good as new after many years wear.

The patentees are prepared to furnish plans, specifications, and estimates, either for the entire construction and erection of gas-works, or for the rearrangement of any part of the apparatus. The Valves are manufactured at the works, at Frome, where also Gasholders, Purifiers, Steam-Engines and Exhausters, Governors, and all other descriptions of Gas Apparatus are made and supplied.

EDWARD COCKEY & SONS.

THE IRON-WORKS, FROME SELWOOD,

March 1, 1869.

"FIVE MINUTES' TALK ABOUT GAS"

Is intended to be given by Gas Companies to their Customers. It is hoped the advice it contains may be the means of correcting mistakes and preventing accidents; and also of assisting the Officers in some of the most difficult of their duties.

Price—1000 copies, £1 17s. 6d.; 500 copies, £1 1s. 6d.; any smaller number, at 5s. per 100.

When 1000 copies are ordered, the official title and address of the Company will be printed on the first page without charge. Any greater number by special agreement as to price.

Apply to J. O. N. RUTTER, Black Rock, BRIGHTON.

TAR PURCHASED,

In Districts contiguous to the Advertiser's Works.

JOHN CLARKSON MAJOR,

TAR DISTILLER AND MANUFACTURING CHEMIST,

WOLVERHAMPTON.

BRANCH WORKS AT

NOTTINGHAM, CAMBRIDGE, & BRIGHTON.

Superior Quick-Drying Black Varnish for every description of Ironwork. Sold in barrels of about 36 gallons. Delivered free to any station in England at 1s. 2d. per gallon, cask included.

PRICE'S PATENT LAMPLIGHTER is recommended to the notice of Gas Companies and local authorities as effecting a great saving in the consumption of Gas and of public lighting.

For particulars apply to R. E. KEEN, 6, Red Lion Court, Fleet Street, London, Sole Agent. Manufacturers, D. HULETT AND CO., 55, High Holborn, LONDON.

O'NEILL'S NATURAL HYDRATED PEROXIDE OF IRON is acknowledged to be the best in the market. It contains 90 per cent. of pure Oxide, is light, permeable, and perfectly free from grit and other deleterious ingredients. Now used exclusively in several of the largest London and provincial gas-works.

JOHN WM. O'NEILL and Co., 57, Bishopsgate Street Within, LONDON, E.C.

ALFRED PENNY, Gas and CONSULTING ENGINEER,

WENLOCK IRON WORKS,

21, WHARF ROAD, CITY ROAD, LONDON.

Mr. PENNY having had a large experience in the construction, alteration, and management of Gas-Works, begs to inform the Directors of Gas Companies that he may be consulted on all matters appertaining thereto. He also manufactures Gasholders, Purifiers, and all the various apparatus used in Gas-Works, and keeps in stock Retorts and Mouthpieces, Socket-Pipes, Bends, Branches, T-pieces, &c. &c.

Plans, Specifications, and Estimates prepared.

D. BRUCE PEEBLES,

Gas-Meter Manufacturer,

FOUNTAINBRIDGE

EDINBURGH.

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c. &c.

SCOTSWOOD FIRE-BRICK WORKS, NEAR

BLAYDON-ON-TYNE.

D. GRANT & CO.,

GAS-METER MANUFACTURERS.

STATION-METERS ANY SIZE,

PHOTOMETERS, EXPERIMENTAL METERS, &c.

GAS-METER WORKS, CROSSCAUSEWAY, EDINBURGH.

CAST-IRON Retorts, Socket-Pipes, with Syphons and all requisite Connexions, Lamp Columns, Wrought-Iron Tubing, Valves, Street Lamps, Sight Holes, Furnace Doors, Ash Pans, Charging and Coke Shovels, Iron Pails, Coke Barrows, Cross Bars, Fire Pots, Pumps, and Iron Borings.

PURIFIERS, CONDENSERS, and SCRUBBERS erected complete, or the materials supplied; and every description of goods in use by gas-works, in stock, at wholesale prices, at

Mr. LYNCH WHITE'S,

Old Barge Iron Wharf, Upper Ground Street,

LONDON.

ADDISON POTTER,

WILLINGTON QUAY,

NEAR NEWCASTLE-UPON-TYNE,

Manufacturer of Clay Retorts, Fire-Bricks, and every description of Fire-Clay Good

GEORGE NEWTON,

(Late Senior Partner of the Globe Meter-Works,)

UNION STREET WEST, OLDHAM,

MANUFACTURER OF

IMPROVED WET & DRY CONSUMERS GAS-METERS,

GAS STATION-METERS,

With all the Joints planed,

GOVERNORS, GAUGES, INDICATORS, EXHAUST GOVERNORS, &c.

TERMS, &c., ON APPLICATION.

THE GAS-METER COMPANY

(LIMITED), LONDON,

(Successors to CROLL, RAIT, and CO., LONDON, and WEST and GREGSON, OLDHAM.)

MANUFACTURE

STATION-METERS & GOVERNORS

At their Oldham Establishment, which has long possessed the reputation of supplying this description of apparatus of the most perfect construction and appropriate design.

CONSUMERS GAS-METERS IN CAST-IRON & TINNED SHEET-IRON CASES.

STREET GOVERNORS, PRESSURE and EXHAUST REGISTERS, TEST GASHOLDERS,

AND EXPERIMENTAL GAS APPARATUS GENERALLY.

For information, &c., apply to

W. ARCHER, Manager, Meter Factory, OLDHAM;

OR TO

GEORGE RAIT, Managing Director, KINGSLAND ROAD, LONDON.

GAS AND WATER PIPES.

CLARIDGE, NORTH, & CO.,

BILSTON.

M'KENZIE'S PATENT GAS COAL.

This Patent Gas Coal is a compound of Pulverized Coal and Shale Oil. It is now used most successfully by some of the London Gas Companies, and also in Dublin and other places, for increasing the illuminating power of the Gas, which it does at less cost than Cannel Coal. The illuminating power of this Patent Coal can be made of any strength required up to 35 candles, and is in all cases guaranteed. The Coke is of the best quality, as the best Newcastle and Sunderland Coals only are used in the manufacture.

This Patent Coal is shipped at Sunderland, where works for its manufacture have been erected.

Further particulars can be obtained from

W. W. JOBSON, 16, Fish Street Hill, LONDON; or

WALKER, BRUCE, & CO., Patent Gas-Coal Works, South Docks, SUNDERLAND.

EXTRACT *from the Inaugural Address of* THOMAS G. BARLOW, Esq., C.E., *President of the British Association of Gas Managers, at their Fifth Annual General Meeting, held in London on the 2nd of June,* 1868.

Gentlemen,—In considering the progress that has been made in the manufacture and distribution of Gas during the past year, the new inventions and new processes which have been adopted or tried with prospect of success, deserve to be specially noticed. Foremost among them is M'Kenzie's process for producing Gas of high illuminating power from small Coal, mixed with crude Shale Oil. The pressure which the Legislature has recently put on Gas Companies to raise the standard of illuminating power considerably above that obtainable from common Coal, has compelled most of them to use a certain proportion of Cannel Coal, at a heavy loss, and with a diminution in the value of the Coke. The advance in the price of Cannel Coal, consequent on the increased consumption, has stimulated inquiry to find a substitute for it; and this seems to have been accomplished by Mr. M'Kenzie, whose process has been successfully adopted on a large scale at the Alliance Gas-Works in Dublin. The small Coal is well mixed with the Oil, in the proportions varying from 10 to 30 gallons of Oil to one ton of Coals. This is effected by means of a mixing or grinding mill. The Compound material is then distilled in ordinary Gas Retorts of clay or iron, at a strong heat. I have recently witnessed an experiment on a mixture of Llantwit Small Coal shipped at Cardiff, and costing in Dublin 12*s.* 6*d.* per ton, with 5 per cent. of Broxburne Shale Oil, costing £5 10*s.* per ton, the produce of the distillation of one ton of which mixture was—

9750 cubic feet of Gas, 21·5 Candles illuminating power.
37 bushels of good hard, saleable Coke.
2 bushels of Breeze.
11 gallons of Tar.
15 gallons of Ammoniacal Liquor, of 5° Twaddle.

The cost of this mixture, including Royalty, was about 17*s.* per ton, against 24*s.* for Wigan Cannel, over which it has the advantage of at least 5*s.* per ton in the value of the Coke.

FOR SALE,

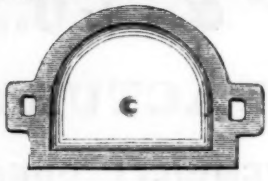
SEVERAL SECOND-HAND STATION-METERS & GOVERNORS,

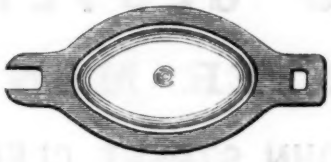
All in excellent Working Order, equal to New, guaranteed.

APPLY FOR FURTHER PARTICULARS TO

GEORGE RAIT, Managing Director, GAS-METER COMPANY,
238, KINGSLAND ROAD, LONDON, N.E.;
OR TO
WILLIAM ARCHER, THE OLDHAM METER MANUFACTORY, OLDHAM.

PIGGOTT'S IMPROVED RETORT-LIDS.


Convex


Rabbeted

Dished

The Manufacturers desire respectfully to call the attention of Gas Companies and Engineers to their Improved Retort and other Stamped Wrought-Iron Lids, which possess the following advantages over Wrought Lids hitherto manufactured:—Uniform size and shape, a smooth and even surface, and a superiority of finish hitherto unattained. These desirable qualifications are preserved *irrespective of form*.

The Manufacturers have recently laid down extensive Hydraulic Machinery, with a view to acquire the above result, and the success they have achieved in this branch of their business has surpassed their most sanguine expectations. The simple fact that these Lids fit into one die, and are stamped and cut out at one blow, is a sufficient proof that they must be necessarily alike in all respects, and superior to any other make.

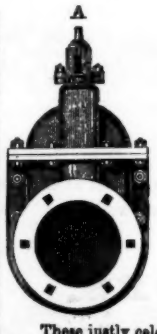
The following Gas Companies have the Lids in use, and can certify to their merits:—

Belfast,	Burslem & Tunstall,	Fazeley,	Luton,	Stoke Fenton and Longton,
Beverley,	Bury,	Gloucester,	Nottingham,	South Shields,
Birkenhead,	Carlisle,	Harrogate,	Nuneaton,	Southampton,
Birmingham and Staffordshire,	City of London,	Huyton and Roby,	Perth,	Stockton,
Bombay,	Cowes,	Leeds,	Preston,	Tunbridge Wells,
Bradford,	Croydon,	Leicester,	Portsea Island,	Victoria Docks,
Brighton,	Crystal Palace,	Liverpool,	Rossendale,	Warrington,
Brighton and Hove,	Derby,	Longport,	South Metropolitan,	&c., &c.
	Equitable, London,	Lowestoft,	London,	

PRICE LISTS ON APPLICATION.

THOMAS PIGGOTT & SON,
ENGINEERS, CONTRACTORS, and IRONFOUNDERS,
GASHOLDER, GAS APPARATUS, & STEAM-ENGINE BOILER MAKERS,
SWALLOW FOUNDRY, SPRING HILL, BIRMINGHAM.

C. & W. WALKERS' GAS-VALVES.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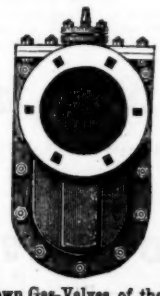
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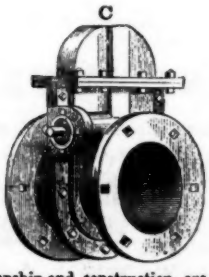
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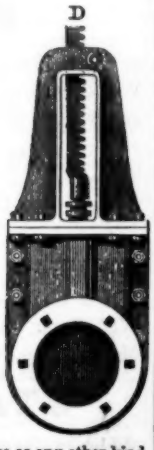
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No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 6, 1869.

Notes upon Passing Events.

THE visit of the Viceroy, or, more properly, the King of Egypt, which is forming a leading excitement in the fashionable season—a pivot on which a great many magnificent entertainments, public and private, are hung—is not a mere matter of amusement. The King of Egypt came to improve his position as a sovereign who practically reigns and governs. He was overshadowed on his previous visit by the presence of his superior, the Sultan; now he reaps all the compliments we are well inclined to pay one with whom our commercial relations are so intimate. It is said that he has made this journey not only to invite the sovereigns of Europe to be present at the opening of the Suez Canal, but to negotiate for its *neutralization*. That is a pretty word, but what does it mean? Egypt is at present our principal road to India. If neutralization means that we are not to use the Egyptian route in time of war, it would be absurd for us, the only nation, except the Dutch, who have a great stake in the East, to agree to such a one-sided treaty. It would mean that, when we most needed it, we were not to use the key of our Indian House. If neutralization merely calls upon the Powers of Europe to agree not to destroy the Suez works in time of war, that is needless. It will be spared, just as open indefensible towns are spared in time of war. But suppose one of two belligerents gets possession of the Suez Canal, and is using it against the interests of the other for the transport of troops or stores to the seat of war, we suspect that paper treaties would scarcely protect the Mediterranean or the Red Sea port from damage, if not destruction.

As to the time when the Suez Canal will be opened to its full dimensions from end to end, accounts differ in an extraordinary manner. The official representatives of the Suez Canal Company declare that in November the canal will open to vessels drawing 26 feet of water. But the other day Mr. Bramley Moore, long chairman of the Liverpool Docks—a man of considerable knowledge and practical experience, not hampered like great engineers who have received splendid hospitality and magnificent fees from the King of Egypt, and certainly not prejudiced against an undertaking from which British steamers will derive the first benefit—told a Liverpool audience that he saw six miles of solid rock as yet to be cut, in addition to the long operation of filling the salt lakes, and that he thought four millions more capital would have to be expended before the canal was completed according to the original plans. At much less expense it may be open for small craft. The discussion about the Suez Canal will be very useful to us if it ripens the minds of our statesmen to the necessity of constructing a new independent railway road to India by the Euphrates line. The only sovereign who has a right to object to our appropriating the needful land is the Sultan. He is dependent on our support against his natural hereditary enemies the Russians. A railroad would give incalculable taxing value to his Asiatic dominions; and from us he has nothing to fear. The rising generation of politicians are not of the peace-at-any-price school, still less of the party who would give up India as an incumbrance. Young Sir Charles Dilke, in his remarkable work "Greater Britain," urges the execution of the Euphrates Valley line, in terms and by arguments which show how strongly a modern democratic Radical differs from the Manchester and the French school of Liberals.

At this period, when the Suez Canal question is assuming so much prominence, it is rather surprising to find a journal like the *Revue Contemporaine*, which has usually treated English questions and institutions in a very impartial spirit, publishing an article inspired by the old hatred of "perfidious "Albion" of the St. Helena school of Bonapartists. The author of "The English and Russians in Asia," a lieutenant in the navy, desires to "show the dangers to which Asia is "exposed from the ambition of England and Russia." "The "one attacking it on the south, the other on the north, "equally threaten to absorb it, to the detriment of other "nations." The object of his essay is to show that Europe ought to interfere to establish a balance of power in Asia, which is as much needed as the balance of power in Europe. M. Lullier quotes, from the St. Helena memoirs, Napoleon's plans for becoming Emperor of the East, with Constantinople for his capital, and he also quotes the following note, dictated by Napoleon to Count Montholon:—"The expedition to Egypt "had the objects—1st. To establish on the Nile a French "colony, which, without slaves, would have replaced St. "Domingo and all the Sugar Islands." This, without the sugar, M. de Lesseps has done. "2nd. To open up markets "for our manufactures in Africa, Arabia, and Syria. 3rd. To "make Egypt the base of operations for an army of 60,000 "men to be marched on India, there to raise the Mahrattas "and other *oppressed* people." "But St. Jean d'Acre barred "the way to Bonaparte, and his destiny recalled him to "Europe"—we presume to raise and liberate the oppressed

Spaniards, Dutch, Prussians, and Russians. For this reason M. Lullier reminds us that Bonaparte for ever cursed the name of Sidney Smith. He then traces the history of the rise of British power in India; and, with plenty of ground for severe comment, to be derived from our own writers and own speeches in Parliament, it seems rather odd that stones should be thrown by a representative of the conquerors of all continental Europe, except Russia and Turkey. Those who almost adored Napoleon I. for his success, would scarcely have convicted Warren Hastings for bestowing an empire on France at any cost; Paris, rich with the spoils of art and treasure of Europe, did not recall Verres in her triumphant soldier and Emperor. Hyder Ali and Tippoo Saib are described by M. Lullier as martyrs and patriots, and no hint is given of the assistance they received, in disciplining their armies, from French officers. By a still more comical misrepresention, M. Lullier represents us as having robbed the Indian peasantry of their right to the soil; and, forgetting the French monopolies of salt and tobacco, reproaches us with our Indian salt monopoly, and accuses us of taxing the wheat of India, as well as coffee, cotton, linseed, silk, and cochineal, with enormous duties! those duties having been repealed five-and-twenty years. Finally, he accuses us of ruining India, whose commerce, he asserts, is steadily declining—an assertion which must very much astonish not only the rich native merchants, but the representatives of French wine growers and Lyons silk manufacturers at Calcutta and Bombay. Not a word of the millions invested on railroads and irrigation, but a statement that land has gone out of cultivation! "One part of the spoils of India "is reserved for the magistrates, who sell justice for golden "bribes; another is reserved for false missionaries." The account of the mutiny is equally curious in its facts. We are here told that the sepoy regiments that marched off with their arms and parks of artillery complete to fortified cities, were "badly armed, and beaten in detail," for want of support; although he is quite right in saying that if a European force equal in number to the British had joined the sepoy murderers, we must have been driven out of India. M. Lullier thinks that India deserves a better fate than to be ruled by the English—the French system, as shown in Algeria, where all power and justice are military, and must be military, in a country where revolt is chronic, would suit India better. "In case of a war with England about "the Suez Canal, thirty-five thousand French troops, de-"tached from the army of Africa, could occupy Egypt." M. Lullier enumerates the points fortified by us to command the navigation of the Red Sea. Sir Charles Dilke relates that a French fleet was sent out to seize Perim, but, halting at Aden, the French admiral, under the influence of the governor's champagne, let out his business. A dispatch, written in pencil during the banquet, was acted on so vigorously, that when the French fleet arrived they found guns mounted and the English flag flying at Perim. After the Red Sea route comes that of Syria from St. Jean d'Acre and Damascus, the valley of the Euphrates, and the Persian Gulf. "The English have had the cunning to establish themselves "on the islands of Ormuz, which command the entrance to "the gulf, under pretext of making a coal dépôt, and the "island of Karnac, which commands the Euphrates." A railway is projected which will join this point to Damascus and St. Jean d'Acre. Large steamers can only navigate as far as Bagdad, to the splendid basin formed by the confluence of the Tigris and Euphrates. "The Porte has already autho-"rized a telegraph line—will it permit a railroad? . . No matter;" and then our author describes how telegraph stations will become forts and barracks, "under the protection of which "the indigenous populations will gather and form important "towns." We trust that the business will be done in a more direct manner; and, now that England claims no exclusive advantages of trade with her dependencies, it would be difficult to understand why any one but a St. Helenaist should object to our establishing the best and quickest route to our Indian Empire. According to M. Lullier, perfidious Albion has also a greedy eye on China. His theory of our universal oppression of native populations is rather contradicted by his fact that Singapore, under our rule, has risen from a mere village to a splendid city of eighty thousand inhabitants. We are happy to learn from him that, after an attentive personal examination, he has come to the conclusion that Singapore is capable of a good defence in time of war, and that Labuan commands the Straits of Borneo. M. Lullier explains his own scheme for founding a model government in Cochin China with clearness and simplicity. The French settlement of Cochin China consists, according to his account, of "only 485 "Europeans, protected by 10,000 soldiers and sailors." It brings in 18 million francs of revenue, and costs 25 million. The climate is pestiferous; every three months 300 military invalids are carried home, many suffering from dysentery; those attacked with fever generally die. "Three new pro-"vinces were acquired by treaty in 1869. With colonists and "capital, the fertile soil of Cochin China could be made very "productive. But at present our operations only transplant a "portion of the Chinese population *on land won from the indi-"genous population by our arms*, and guarantee the security of "our colonists at the expense of our budget and the health of "our soldiers and sailors. French Cochin China might "achieve a great future by extending towards the north to "China, and towards the west and north-west toward Burmah "and the kingdom of Siam. This would involve a long war "with the English, in order to expel them from the island of "Johore, Singapore, Malacca, and the island of Labuan!" What should we say if an article in the *Quarterly Review* proposed to conquer all the French settlements in India and Cochin China? However, we need not refer to English books to refute M. Lullier; we are content to abide by the reports of French travellers, from Jaquemont downwards. The odd thing is, that a serious French review should issue such an article at this moment, when the question of the Suez Canal is about to pass from theory to reality, and in such a tone, when for nearly a quarter of a century the ports of all our colonies and dependencies have been as free to French manufacturers as to our own.

The Crystal Palace, like the London, Chatham, and Dover Railway, is one of the undertakings by which the country benefits enormously, at the expense of the unfortunate investors who found the capital. Without the Crystal Palace we should be obliged to fall back on the stale and monotonous entertainments common to all capitals—reviews of troops and theatrical representations—to entertain illustrious foreigners. To make a review imposing, quantity must always be an essential part; and there we cannot rival continental sovereigns. The opera is the same everywhere, and must bore Orientals who are not musicians. But the fountains, the gardens, the scenery, and the fireworks of the Crystal Palace, with its tens of thousands of gaily dressed visitors, cannot be approached for pleasurable charms even by Versailles. The Viceroy's day was a gratifying, exciting scene; but, in the meantime, the shareholders seem as far off a dividend as ever. The expenses of repairs and of the indispensable machinery eat up all possible profits, and will continue to do so until by some means the roof and sides are rendered less perishable—less dependent on an army of glaziers, plumbers, painters, and carpenters. Sunday opening would probably give a dividend, but the advocates for shutting drinking-shops and opening the Crystal Palace on Sunday are not yet a majority either in or out of Parliament. Why the "Dog and Duck," with its fusty arbours, Highbury Barn and Cremorne, with their doubtful reputations, should be opened on Sunday, and the Crystal Palace closed, it is difficult to say. Such is the law of the company's charter, and any attempt to repeal the clause would fail. Mr. Francis Fuller—an admirable auctioneer, well acquainted with the value of every article, from a hog's bristle to an oak-tree, but whose acquaintance with science, art, and literature is quite of the daily penny paper kind—has been giving his name to a pamphlet of good advice to the shareholders of the Crystal Palace, not mindful of Dr. Samuel Johnson's observation, "Before you advise, sir, "you should consider whether your advice is worth having." Mr. Fuller considers that the Crystal Palace fails because the cultivation of art and science has been superseded by comic singing, dancing dogs, performing monkeys, and things of that sort. This is being rather unfair to the present directors. Mr. Fuller was one of the founders of the Crystal Palace, to whose reckless extravagance and mismanagement the present hopeless condition of the company is due. He was managing director at a salary of £5000 a year, and proved such an utter failure that his co-directors were glad to give him a handsome bonus to depart and leave them alone. You may see Mr. Fuller's notions of art in an *omnium gatherum* collection of plaster casts, and of science in stuffed beasts and models of various dark-skinned tribes not equal to Madame Tussaud's show. The Crystal Palace cannot be made a college or a school, but something nearly as good for a great City—a place of wholesome

and harmless amusement. Gardens, fountains, galleries adorned with greenhouse trees and shrubs, birds and flowers, good music, an excellent reading-room—these are enough for ordinary days; for extraordinary days, the resources of a good showman must be called into operation. The showman is still wanting. None of the institutions founded to combine art and science with the daily shilling have succeeded, although tons of cant have been applied to launch them in Leicester Square, Regent Street, and Sydenham. Mr. Fuller has two patent plans for improving the finances of the Palace Company, one of which is a lottery, disguised by substituting objects of art for money. Lotteries are illegal. If to help the Crystal Palace the Legislature chooses to legalize this form of gambling, the objects of art had better be put aside, and money prizes, pure and simple, substituted. As to the idea of issuing some thousand life admissions, the infallible result would be to destroy the interest of every great *fête*. For, as identification would be impossible, the non-transferable tickets would be the daily subject of barter, sometimes for sixpence, and always for less than the admission charged at the Palace. Mr. Francis Fuller has evidently not learned, by his many failures, how to set the Crystal Palace on its financial legs.

Next year, the Church Question being settled, our Parliament is to tackle the Irish Land Question. This will be a tough nut to crack, for Irishmen do not look on land with English eyes. The ideas of all classes, up to the highest, on the subject of compensation for improvements, real or imaginary, would be considered quite romantic by any Norfolk or Lincolnshire farmer. For instance, we heard the other day that the widow of an Irish gentleman applied, through a relative—an Irish Protestant Bishop—to be forgiven two years rent in arrear for a country house and garden. The landlord, or rather landlady, resident in England granted the Bishop's prayer. Then came a second request, that a sum of money—about a hundred pounds—should be paid for *unexhausted* improvements, in the shape of a conservatory, which had been built by the gentleman who could not pay his rent. This demand having been refused, the owner of the property was denounced in a strong letter as an oppressor of the widow and the orphan. Both landlord and tenant in this case are Protestants and gentry. What can you expect from Catholic peasants? The *Standard* published the other day the following correspondence, which illustrates the same sort of feeling amongst parties in a very respectable position in life. It is evident that no English Parliament can understand the Irish Land Question:—

I may mention that the property of which ——— hold part is situated in the county of Mayo, near Hollymount, and which I inherited from my cousin some years ago.

No intention has ever been expressed by me of selling the property the present tenant holds under a lease granted by my cousin, March 25, 1854, for the term of his life or 21 years: it consists of a handsome house, demesne and other lands, 494 acres, at a yearly rent of £315; it was, at the time of letting, in good condition. It was let upon such low terms that I made every exertion to purchase the remainder of his term, for which, six years since, he asked no less a sum than £1200, which sum I agreed to give; but I found on inquiry that he had no power to sell the remainder of his lease, from some reason I could not ascertion, personal to himself.—I remain, Sir, yours faithfully,

JOHN HENRY BLAKE.

The Heath, Napleton, Worcester, June 26.

Hope Cottage, The Green, Richmond, Surrey, June 21.

Dear Sir,—A friend casually mentioned to me a little while ago that he thought you had some intention of selling Armefield; if so, would you at your leisure kindly inform me what the nature of your estate in the property is, and what you consider it worth.

As you are doubtless aware, we received the place from Mr. Bowen in a very wretched condition; it is now in an excellent state, but our lease leaves us very great powers over the land.

I fancy the land law now impending, and which the Government will doubtless pass next year, will protect the rights of the tenants and enforce either compensation or renewal of leases; but it might possibly suit your wishes and ours to come to some mutually satisfactory arrangement now.—Yours faithfully,

J. H. Blake, Esq., &c.

What is to be the law about gambling? Gaming houses and gaming clubs, like Crockford's and the Coventry, have been put down; roulette tents at races are no longer allowed; thimble-rig and pitch-and-toss are equally criminal in the eyes of the police; and list shops, on which more than one betting bookmaker founded his fortune, have been suppressed by a special Act of Parliament. The most recent attack on the trade of "Ruin Made Easy" has been the arrest of the flourishing gentlemen who call themselves commission agents—people who keep capital balances at respectable banks, and shake hands with many disreputable peers. But if the trade of betting broker is illegal, how long are the subscription-rooms at Tattersall's—where half the peerage, and a proportionate number of the House of Commons, resort daily in the season—to be tolerated? Where is the line to be drawn at which roguery and folly shall be allowed to meet? Times are altered, perhaps, since Lord George Bentinck hurried an Act through the Houses to protect himself from penalties under an old Act of Parliament for illegal betting; but still one can scarcely believe that law will meddle with that temple of Mercury and Plutus—Admiral Rous and a high priest and augur. At every race-course there is a sacred enclosure where "The Ring" howl forth their challenges to the world of backers and plungers. Are these to go too? And if not, why not? Perhaps the resource will be to hand the unconquerable vice over to the Chancellor of the Exchequer, and make every gambler take out a licence for the year or the season, as if he were a dog. Under Prussian rule the tables of Baden and Homburg are soon to disappear, and those of Spa, too; only Monaco will remain a city of play. We can neither see how Tattersall's is to be left alone or attacked. If left alone, with what consistency can small hells of the same kind be pounced on; if attacked, we suggest it should be on the settling-day after the St. Leger. Then, indeed, there would be a haul of golden fish in the police net. Flour-sacks would be required to carry away the bank notes; a "Court Circular" and "Peerage" to mark off, instead of writing down so many noble and fashionable names and addresses. A duke and an earl in the Bankruptcy Court; an ex-Lord Chancellor's son a forger! These are strange times!

THE REPORT OF THE ROYAL COMMISSION ON WATER SUPPLY.

THE long-expected report of the Royal Commission on the water supply of the metropolis is now before us. Not oppressed by a foregone conclusion, like the Board of Health Report of 1850; wider in its scope than the report of the Chemical Commission of 1851; and (unlike the report of Messrs. Hofmann and Blyth of 1856) embodying the opinions and the results of all the most eminent chemists of the day, this report and its appendix form the most valuable documents ever issued relating to the water supply of London.

The report first deals with the schemes for supplying London with soft water from the mountainous districts of England and Wales. The latter—Mr. Bateman's scheme—is discussed at considerable length. In an engineering point of view, the commissioners believe it quite practicable; but, as regards the cost, they consider Mr. Bateman's calculations open to doubt. So, also, it is said, are his estimates of the quantity of water to be obtained. The drainage area marked out by the author of the scheme is 204 square miles, and the probable average rainfall is estimated at about 75 inches. After making all necessary deductions, it is calculated that the quantity of water available for the metropolitan supply would amount to 219 million gallons per day, which might easily be increased to 300 million gallons. Authorities differ, however, as to the amount of rainfall to be expected. By some, also, the storeage proposed by Mr. Bateman is considered insufficient; and objections are made on the score of the danger to be apprehended from any accident happening to artificial reservoirs at such an elevation, and containing such an immense storeage of water.

The quality of the water to be obtained is considered satisfactory as regards its softness and purity. It is likely, however, to be coloured by peat, and a coloured water would not be acceptable in London. Further, several of the samples collected in the district for the commissioners were found to act upon lead, and although the risk of danger from this source is considered small, it is wisely said that with soft water this risk must always exist.

The cost of the works necessary for the supply of 230 millions of gallons a day, Mr. Bateman estimates at a little over £11,000,000, but this does not include the purchase of existing works or interests. If the scheme should ever be brought forward in Parliament, it would certainly have to encounter a powerful and determined opposition from interests connected with the river Severn. Lastly, the commissioners note the danger of having so large a population as that of London and its suburbs dependent solely on one supply of water, which might be so easily stopped by any one of several causes, such as wilful damage, frost, or the failure of any work along the line.

Mr. Bateman's financial plan seems to meet with the full approval of the commissioners; they, in fact, recommend its

adoption, as will be seen when we come to their concluding remarks on the general control of the water supply.

The scheme of Messrs. Hemans and Hassard, for supplying the metropolis from the Cumberland and Westmoreland lakes, is disposed of more shortly. It is pronounced practicable. The quantity of water to be obtained is considered abundant; and, subject to the same objections mentioned in the Welsh case, the quality of the water is considered satisfactory. But there are the objections from a possible stoppage of the supply, stronger than in the case of the Welsh scheme, from the greater length of the conduit. Lastly, it is urged that the district contributing the water is not unlikely to be claimed as the most natural source of supply for the large and increasing manufacturing populations in the north, to whom the gathering-grounds geographically belong.

After a brief reference to the plan of Mr. H. Fulton, for taking a supply from the upper sources of the river Wye, and that of Mr. Remington, who proposes to bring water from the Derbyshire hills, the commissioners make some remarks on gravitation schemes generally. The experience with those, it is said, has not yet been so extensive as to enable engineers to make accurate calculations, in all cases, as to their sufficiency. The commissioners mention the failures at Liverpool, Bristol, and Newcastle-on-Tyne, and note the deficient supply experienced last year in nearly every town supplied from catchment reservoirs; and, in contrast to this, it is remarked that during the exceptionally long drought of 1868, the Thames and the Lea seem not to have been diminished in volume below the ordinary flow of dry years—a result entirely due to the equalizing effect of the great subterranean stores contributing to their flow; from which remark it is easy to gather the commissioners preference for river and spring supplies.

The commissioners next deal with several plans or proposals of various degrees of magnitude, having for their object the supply of the metropolis wholly or partially:—1. From the Thames or its tributaries; 2. From the Lea; 3. From the chalk and Oolite formations in the basin of the Thames; and 4. Some miscellaneous sources. With these we need not now detain our readers, nor need we notice here the review of the present arrangements for the water supply of the metropolis. We come at once to the most important part of the report—that which treats of the supply of water available from the basin of the Thames. First, as regards quantity. After a careful consideration of the evidence of our leading engineers, the commissioners express their belief that the 110 millions of gallons per day the companies are now empowered to take may be safely drawn from the river itself; and that, by storing the flood waters, this quantity might be doubled, if required. There was great unanimity of opinion among the witnesses on this point, some of them expressing a confident belief that more than double the statutory quantity might be safely taken from the main stream at any time. The subsidiary basin of the Lea, it is considered, is not calculated to supply more than 50 millions of gallons daily; and from the chalk to the south and south-east of London another 30 millions of gallons a day may be drawn, giving a total of 300 millions of gallons.

The commissioners next consider the quality of the water. Thames water usually contains from 15 to 20 grains of mineral matters, about three-fourths of which are hardening ingredients. Taking the average hardness at 15° before boiling, a table given in the report shows that after boiling it is about 5°. The Board of Health Report of 1850 having strongly condemned the use of Thames water on account of this hardness, the commissioners discuss at some length the effects of hardness in regard to the use of water for drinking, for culinary use, and for washing and manufacturing purposes. As regards the effects on general health, the evidence is somewhat contradictory; but the report states that there is no reason whatever to suppose that the hardness of Thames water is in the least degree prejudicial to health. So far as culinary operations are concerned, the most important objection to a hard water seems to be the incrustation of kitchen boilers; but the commissioners state that, practically, with Thames water this inconvenience is not great. The evidence is tolerably conclusive as to the advantage of soft water over hard for washing and manufacturing purposes in general. Soft water is certainly more economical for washing, but the advantage is probably much over-estimated. In respect to manufacturing operations in general, all the witnesses agreed as to the economy of soft water; but the commissioners are careful to mention that the largest and most important manufactories in France for silks, woollens, and cottons, have arisen in towns using hard waters—most of them situated in chalk districts. Taking into consideration also the fact that the amount of manufacturing industry in the metropolis, of a kind to require soft water, is but small, the commissioners do not see that the advantages are sufficiently important to justify going to a great distance for soft water, when there is an ample supply of only moderately hard near at hand.

The commissioners devoted a great deal of attention to the subject of the organic impurities in Thames water, and to the question of their removal by natural causes. The evidence on these matters is voluminous, and, it is unnecessary to say, contradictory. But, after a full consideration, the satisfactory conclusion is come to that, notwithstanding the amount of excrementitious matter thrown into the river (which, by the way, is by most people greatly exaggerated), chemical analysis, in the present state of science, fails to detect in the water anything positively deleterious to health. Whatever may be the difference of opinion as to the time required for the removal of all objectionable matter, all the chemists agree that in Thames water, taken from its present source and properly filtered, all such matter has disappeared, and that the resulting compounds, such as nitrates, &c., remaining therein are innocuous and harmless. It is asserted by some, however, that water once contaminated with sewage may contain living germs capable of propagating such diseases as typhoid fever and cholera, but which may not be discoverable either by chemical analysis or the microscope, and not certainly removeable by filtration, and hence water once contaminated is unfit for domestic use. The commissioners express themselves cautiously on this matter. They consider that the doubt of the existence of these germs should operate as a constant stimulus to investigation, but, at the same time, do not admit their existence sufficiently well established to form any conclusive argument for abandoning an otherwise unobjectionable source of water supply. In this opinion they will have the concurrence of all but the few talented and well-meaning enthusiasts who believe in the presence and danger of these germs. It is considered, however, advisable that the provisions of the Acts of 1866 and 1868 should be extended higher up the tributaries of the Thames and Lea, so as to exclude all possible sources of pollution, and then, with perfect filtration, there can be no doubt that water taken from the present sources will be perfectly wholesome. It is worth mentioning here that the analyses, made expressly for the commission by Drs. Frankland and Odling, show that the present point of intake on the Thames is the best that could be chosen in the whole course of the river.

The commissioners have a few words on the Registrar-General's monthly reports, and the value of the meaning to be attached to "previous sewage contamination." It is difficult to condense their remarks on this subject, but it is clear that they do not regard the presence of nitrates as any indication either of the amount, or even possibility, of previous sewage contamination. They dwell, too, on the absurdity of speaking of the mineral matters in waters as "impurities." They are so, no doubt, in a chemical sense; but, inasmuch as these substances are constantly present in natural waters, they must be regarded as normal constituents. The multiplication of the small amounts of these matters into tons is also condemned as "unphilosophical," and as calculated to create unfounded alarm.

We have mentioned that the quantity of water to be obtained from the present sources is estimated by the commissioners at 300 million gallons a day. What are the probable future requirements of London, with the introduction of the constant supply recommended in the report? It is calculated that the maximum summer consumption for a population of five millions will require 200 millions of gallons per day (that is, 40 gallons per head), which the commissioners regard as the highest demand that may be reasonably looked forward to. The London companies, with their present legal powers, and only moderate additions to their engineering means, represent themselves as able to supply 180 million gallons per day—only 20 millions short of the highest estimated demand.

We have intimated that the report recommends a constant service supply, at high pressure, and the compulsory supply of the poor. It is admitted that the companies have honestly done their best; but the commissioners consider that a constant service system cannot be effectually introduced into London while the supply is in the hands of private companies. Hence

it is recommended that the control of the water supply should be placed in the hands of a municipal body, as at Manchester, Glasgow, and elsewhere; and that there should be a power of levying two rates, one a special or domestic rate on all dwelling-houses, the other a general rate on all rateable property.

This last recommendation is one that will excite much discussion in London, and our readers will be certain to hear a great deal on the subject.

Circular to Gas Companies.

The Imperial and South Metropolitan Gas Companies have carried their Bills safely through the committee of the House of Lords, and unless opposed on the third reading, they will most probably receive the Royal Assent without having undergone any further substantial alterations than were made by the committee of the House of Commons. The Bill of the Imperial Company passed triumphantly through the opposition raised to it by the Metropolitan Board of Works. It came before the committee, of which Lord Methuen was chairman, on Thursday last, and after Mr. Hope Scott had placed before them the history of the company, and had stated the various vexatious oppositions to which they had been subjected in attempting to discharge the duties imposed on them by Parliament, and the present position of the company, the committee appeared to be fully prepared to give a favourable consideration to the case of the promoters. The evidence of Mr. Burke completely satisfied them that there was no reasonable pretext for the opposition of the Board of Works, whose case was not improved by the allegation in their petition, that the Imperial Gas Company, having a widely extended and comparatively thinly populated district, were better enabled on that account to supply gas cheaply than the Chartered Company in their densely populated district. It was shown, in reference to that point, that the gas-rental of the latter was £63,000 per square mile, while that of the Imperial Company did not exceed £29,000. The effect of the evidence in refutation of that objection to the Bill was to satisfy the committee that in consideration of the extensive district of the Imperial Company, now being rapidly built upon, the required amount of capital was not too great. With regard to the proposed new site for the company's works near Barking, Mr. Burke admitted that it was not so desirable as the one originally fixed on near Victoria Park; but he said that, having been compelled by the agitation raised against that site to abandon it, and choose another, there was none in the neighbourhood of London more eligible than the one at Barking, though it would put the company to additional expense. The proceedings of Mr. Cardwell's committee were animadverted on very strongly, and the sum and substance of the report of that committee was thus briefly described by Mr. Burke: "The report began with "the statement that the Metropolis Act had been too favour-"able to the gas companies, and concealed the fact that the "gas companies under the operation of the Act had reduced "their charge £300,000. It then went on to say that we "ought to give 16 candles for 3s. 9d. per 1000 feet, which was "a price and an illuminating power which would have been tanta-"mount to our ruin. Then it went on to state, 'Although we can-"not do justice, and, according to parliamentary usage, compel "you to adopt these terms, yet if you do not accept them we "will recommend to Parliament a means of ruining you by "competition.' That is the report in little." As to the question of amalgamation, it was observed that the Imperial Company's district lies within what may be called a ring fence, and that, independently of its extent—comprising an area of nearly one-fourth of the whole of the metropolis—there could not be the same advantage from amalgamation in their case as there might be from an amalgamation of gas companies whose districts interlace one with another. The further consideration of that matter was, however, set aside by a declaration of the committee that it was a question they would not consider. In the course of the cross-examination of Mr. Burke, it was attempted to make a point against the Imperial Company by showing that they had acted contumaciously against the recommendations in the report of Mr. Cardwell's committee; but the chairman very properly put a stop to further questions in that direction, by observing, "The com-"mittee feel they are not bound by Mr. Cardwell's report;" and at the conclusion of Mr. Burke's evidence, after a brief deliberation, they came to the following decision:—"The com-"mittee are of opinion that the promoters have shown a very "strong case indeed; but the committee are, of course, ready "and willing to hear any evidence which may be given on the "part of the opponents of the Bill, but they feel bound to "express themselves as strongly as they can that they con-"sider the evidence as given by the promoters to be very "conclusive upon the question, and they are also bound to "remark that the cross-examination of Mr. Burke has not "shaken his evidence on any one point." After that decision, the counsel for the company felt it to be unnecessary to tender any further evidence, though he said he was prepared with the evidence of engineers, who would go into the minutest details, and with that of every officer of the company, and he challenged investigation in the fullest possible way. Mr. Rodwell, who appeared on behalf of the Metropolitan Board of Works, after the strong expression of opinion by the committee in favour of the promoters of the Bill, requested an adjournment of the proceedings, to enable his clients to consider what course they should adopt. There was another petition against the Bill, signed by nine consumers, and though the committee considered they had a *locus standi*, the chairman said he thought it a mere waste of time to listen to any evidence or argument in favour of that petition, as all the evidence given on the subject, in the previous investigations, was printed. On the following day neither the Metropolitan Board nor the other petitioners produced any evidence against the Bill, though they threatened to go into the two questions of the reserve-fund and illuminating power. The committee, after some consideration, with the printed evidence given in preceding years before them, unanimously agreed that the preamble of the Bill had been proved, and the clauses were all agreed to. It is highly satisfactory to find, by the decisions of the committees of both Houses on the Imperial Gas Company's Bill, that the endeavour to bind parliamentary committees slavishly to the adoption of the recommendations of Mr. Cardwell's report, and to the provisions of the "Model "Gas Act" of 1868, has been thus successfully defeated. The whole of the evidence adduced in support of the Bill shows how absurd and unjust it would be to adopt rigid provisions, binding on all gas companies alike.

The Standing Orders Committee of the House of Commons have, as we predicted they would, refused to give the Chartered Gas Company permission to introduce a Bill into Parliament for the purpose of deferring for twelve months the operation of the City of London Gas Act of 1868; the provisions of that Act will, therefore, come into full force on all the City gas companies, and on the Chartered Company in their district beyond the boundaries of the City, from the 1st of January next.

The instructions of the gas referees to the gas examiners are attracting attention in the public press, and will, no doubt, open a new field for declamation by gas agitators. It seems to be admitted that the adoption of Sugg's new London burner as the standard, in lieu of Sugg's Letheby burner, will have the effect of increasing the indicated illuminating power of the gas two candles, thus making 14 sperm candle gas apparently equivalent to 16 candles. The referees have proceeded on the principle for which we have always contended, that the illuminating power of gas is the light to be obtained from it by combustion under the most favourable circumstances generally applicable; and, practically, it matters not to the consumers whether they obtain the same amount of light by improved means of burning the gas or by improvement in its quality. It is a question, however, that may well be taken into consideration by Parliament in regulating the standard of illuminating power, but with that the gas referees have nothing to do. A temperate article on the subject appeared in the *Standard* last week, pointing out the inconsistencies in the price and in the illuminating power of gas in different parts of London, which it is erroneously asserted will be increased by the partial adoption of the new standard burner in testing the illuminating power. That burner will, on the contrary, tend to equalize the illuminating power of the gas supplied by the different metropolitan companies, for those companies who are bound by the Metropolis Gas Act of 1860 to supply 12-candle gas will continue to have it tested by the parliamentary burner, which indicates two candles less illuminating power than the Sugg new London burner, by which the 14-candle gas of the other companies will be tested. The article in the *Standard* has urged Mr. G. W. Stevenson to rush into print with further

illustrations of existing anomalies in the supply of gas, regardless of the delicacy which usually restrains professional men from entering into newspaper controversies, especially in cases wherein they may be professionally engaged. He recommends the creation of a Royal Commission, with the view of obtaining a public Act of uniformity in the supply of gas to the metropolis; and in that case it may be presumed that Mr. G. W. Stevenson would conceive himself to be eminently qualified to be appointed one of the Royal Commissioners.

A movement has been originated in Southport for the removal of the Corporation Gas-Works from the centre of the town to some more fitting place in the neighbourhood. Whatever may be said in favour of gas-works, as being conducive to health instead of being prejudicial, there can be no doubt that gasholders, as at present constructed, possess no architectural beauty, and that even in the best managed gas-works effluvia are occasionally emitted which, to say the least, are not agreeable. It is very desirable, therefore, in a place like Southport, which relies greatly for its support on the attractions it has to offer to visitors, that gas should not be manufactured in the very centre of the town, if there be any other accessible and appropriate site for the purpose. At a recent meeting of the ratepayers and property-owners of the town, a respectful memorial to the mayor, aldermen, and councillors was agreed to, against the proposed extension of the present works, and in favour of their gradual removal as soon as practicable. The memorial well deserves attention, for it must be admitted by all that the gas-works on their present site are injurious to the prosperity of Southport.

It appears from the annual report of the inspector, presented to the Lighting Committee of the Dublin Corporation, that the adoption of the average meter system of indication has effected a great saving in the expense of the public lighting in that city, without perceptibly diminishing the quantity of light. The amount saved in the year ending in April last is stated to have been £3701.

After a retirement from public notice of some years, Mr. T. A. Hedley has reappeared on the platform of agitation as the advocate for the formation of a new gas company at Bilston to compete with the old company, in whose service he has been latterly engaged. The success of his renewed agitation has not, however, been very great, for a large majority of the meeting, whom he exhorted to supply themselves with cheap gas, deemed it more expedient to appoint a committee to wait on the directors of the Bilston Company to solicit a reduction in the price of gas, than to pledge themselves to the formation of a new company.

The Glasgow Corporation Gas (Purchase) Bill has received the Royal Assent, and, as a proof that the sale of the gas companies undertakings has been an advantageous operation, it may be stated that the price of the shares has risen 10 per cent. since the agreement with the Corporation was completed; the £25 shares of the Glasgow Company, which previously were quoted at about £50, have risen to £55½, and the shares of the Glasgow City and Suburban Gas Company have risen in the same proportion. Purchasers at that rate will receive about 4 per cent. in annuities on their purchase-money.

The Crystal Palace District Gas Company, for the purpose of preventing robberies by men pretending to be officers of the company, have adopted the plan of putting their inspectors and fitters into uniform, and they have issued a notice warning gas consumers against admitting any one not so accoutred into their houses under the pretext of inspecting the meters. It is an excellent plan, and we recommend its adoption by all other large gas companies.

The Parisian Gas Company is threatened with opposition. A company has been formed, and capital, it is said, has been raised, to purchase the patents of M. Tessié du Motay, for the production of oxygen and hydrogen, with the view of manufacturing those gases on a grand scale, and distributing them over Paris, for the general use of the oxy-hydrogen light. It is modestly proposed to begin with only a part of Paris—the best quarter; and application has been made to the Préfet of the Seine for permission to lay down the necessary pipes. There is small probability, we should think, that the permission will be granted, and the scheme will no doubt soon collapse. It would seem, too, that the concession of the Parisian Company gives them the sole right to supply illuminating gas to the city; and, if oxygen and hydrogen should be required, the company might be compelled to manufacture them. There are, however, so many difficulties in the way, and such serious objections to the system it is proposed to introduce, that we can hardly imagine the Municipal Council giving any attention to the proposal. In the first place, a double service is required in the streets and in every house; thus the cost of "installation" is at once doubled. Next there is the expense of the two gases, for which we have at present only the assertions of the promoters of the scheme. Lastly, there is the great danger arising from the possible escape of two inodorous gases forming a highly explosive mixture, of which no notice would be given until the explosion had occurred. Admitting the ingenuity and relative cheapness of the process by which M. Tessie du Motay obtains oxygen, it is inconceivable that the gas can be supplied at anything like the cost stated in the prospectus of the company—about 1s. 10d. per 100 cubic feet. A process which looks simple and practicable when applied on the small scale, as we saw it in the Paris Exhibition, becomes quite unmanageable when it is attempted to adapt it to the supply of even a small portion of the city. The same remark applies to the process for obtaining hydrogen, a supply of which is promised for about 7d. per 100 cubic feet. It is worthy of notice here that although the Préfet, at the request of the inventor, appointed a scientific commission to examine into the cost of the oxygen, the members have never thought it worth their while to visit the works of the company. The scheme is, in fact, utterly chimerical, and as such it seems to be treated by all really scientific men. It should be mentioned that the promoters intend to apply oxygen in two ways—first, with pure hydrogen and the Zirconia cylinder, for the production of the Drummond light; and, secondly, to supply it to an Argand burner consuming common gas, which will necessitate trebling the consumption of gas, without obtaining any proportionate increase in illumination.

Correspondence.

MR. HEISCH AND THE GAS REFEREES.

SIR,—On reading your summary of the second report of the gas referees, and Mr. Heisch's criticism on their instructions, I procured a copy of these documents, in order to understand the questions at issue.

The most important objection taken by Mr. Heisch relates to the testing for ammonia; and, with all deference to him, I must say he has fallen into a great mistake, which wholly invalidates his objection. His objection is, that as the referees direct that only one-tenth of the liquid obtained from the test be subjected to analysis, this is too small a portion to yield a reliable result. As he states that he can read off from the alkalimeter tubes to the 100th part of a grain, he obviously does not object to the apparatus, but only to the small quantity of the liquid subjected to the test. As only one-tenth of the liquid is taken, and as 25 feet of gas are passed through it, he says that any divergence from exactitude in reading off from the alkalimeter tube must be multiplied forty times in ascertaining the amount of ammoniacal impurity in 100 feet of gas.

In this he makes a great mistake. On reading the instructions of the referees, I find that the solution of ammonia employed in the testing is so diluted that ten measures of it are required to neutralize one measure of sulphuric acid in the liquid tested. Hence it follows that the volume of ammoniacal solution (run out from the tube) is as great as if the *whole* of the liquid had been subjected to analysis, if the ammoniacal solution had (as usual) been of the same strength as the sulphuric acid. The reading of the tube, therefore, must be as plain and accurate as if the whole of the liquid had been tested. Moreover, the smaller quantity of liquid tested renders the change of colour in it more readily apparent.

GEORGE HOWELL.

University College Hospital, London, W.C.,
July 3, 1869.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JUNE 21, 1869.

The GLASGOW CORPORATION GAS (PURCHASE, &c.) Bill was reported, without amendment.

The SPALDING WATER Bill was read a third time, and passed.

The ST. HELEN'S BOROUGH IMPROVEMENT Bill was referred to a Select Committee, consisting of Lord Meredith (chairman), Earl Denbigh, Earl Radnor, Lord Sheffield, and Lord Aveland, who will sit on Friday, June 25, at eleven o'clock.

TUESDAY, JUNE 22.

The following Bills received the Royal Assent:—The WEST HAM GAS; EDINBURGH PARISH POOR-HOUSE WATER SUPPLY; GREAT YARMOUTH WATER; GREENOCK WATER; DUMBARTON WATER, &c.; CLECKHEATON GAS; RADCLIFFE AND PILKINGTON GAS; CONSETT WATER; WALTHAM ABBEY AND CHESHUNT GAS; SHOTLEY BRIDGE AND CONSETT DISTRICT GAS; DARWEN WATER; DUNDEE WATER; WINDERMERE DISTRICT WATER;

Bishop's Stortford Water; Bridgend (Glamorganshire) Gas and Water; Accrington Gas and Water; Spalding Water; Glasgow Corporation Gas (Purchase, &c.); Barnstaple Gas; and Oswaldthwistle Local Board.

The Glasgow Corporation Gas (Purchase, &c.) Bill was read a third time, and passed.

The Barnstaple Gas Bill was returned from the Commons, with the amendments agreed to.

Thursday, June 24.

The Maryport Town and Harbour Gas Bill was read a third time, with the amendments, passed, and sent to the Commons.

Friday, June 25.

The Huddersfield Water Bill.—Lord Abercromby was appointed a member of the Select Committee, in the place of Lord Leigh.

The Keighley Water Bill was referred to a Select Committee, consisting of the Earl of Devon (chairman), Marquis of Exeter, Lord Camoys, Lord Boyle, and Lord Grinstead, who will sit on Thursday, July 1, at eleven o'clock.

The Imperial Gas; the South Metropolitan Gas; and the Bradford Water Bills, were referred to a Select Committee, consisting of Lord Methuen (chairman), the Duke of Grafton, Earl Dartmouth, Viscount de Vesci, and Lord Fitzwalter, who will sit on Thursday, July 1, at eleven o'clock.

Tuesday, June 29.

The Glasgow City and Suburban Gas, and the Glasgow Gas Bills, were withdrawn.

The Cleveland Water Bill was reported, with amendments.

The Maryport Town and Harbour Gas Bill was returned from the Commons, with the amendments agreed to.

The Kingstown Town, and the Huddersfield Water Bills, were reported from the Select Committee, with amendments.

Thursday, July 1.

The Keighley Water Bill was reported, with amendments.

The St. Helen's Borough Improvement, and the Manchester Corporation Water-Works and Improvement Bills, were reported from the Select Committee, with amendments.

Friday, July 2.

The Imperial Gas, and the South Metropolitan Gas Bills, were reported from the Select Committee, with amendments.

The Milnrow Gas Bill was returned from the Commons, agreed to, with an amendment.

The Cleveland Water, and the Huddersfield Water Bills, were read a third time, with the amendments, passed, and sent to the Commons.

HOUSE OF COMMONS.

Monday, June 21, 1869.

The Barnstaple Gas and the Oswaldthwistle Local Board Bills.—The Lords amendments were agreed to.

The Dorking Water Bill was read a second time, and committed.

Tuesday, June 22.

The Walton-on-Thames and Weybridge Gas, and the Milnrow Gas Bills, were reported, with amendments.

Monday, June 28.

The Milnrow Gas Bill, as amended, was considered.

Tuesday, June 29.

The West Surrey Water, and the Dorking Water Bills, were reported, with amendments.

The Maryport Town and Harbour Gas Bill.—The Lords amendments were agreed to.

Wednesday, June 30.

The Aberdare and Aberaman Gas Bill, as amended, was considered, and amendments made.

The Truro Water Bill was read a second time, and committed.

Thursday, July 1.

The Milnrow Gas Bill was read a third time, and passed, with amendments.

The Walton-on-Thames and Weybridge Gas Bill, as amended, was considered.

Friday, July 2.

The Oxford Gas Bill, as amended, was considered, and a clause added.

HOUSE OF COMMONS.

(*Before the Right Hon.* T. E. Headlam, *Chairman*; *Mr.* P. Rylands, *Mr.* J. Whatman, *and Mr.* H. Bruen.)

HUDDERSFIELD WATER BILL.

(*Continued from page* 498.)

Tuesday, April 27.

Professor *David Thomas Ansted*, examined by the Hon. G. Somerset.

I have visited the district near Huddersfield for the purpose of inspecting the area from which it is intended to obtain water. The condition of the water supply from the surface in this neighbourhood depends partly on the physical geography of the district, and partly upon its geology. The great mass of the mountain ridge that extends from Derbyshire to the extremity of Yorkshire, and so on northwards, separates the west from the east, and the rainy winds coming from the west have to pass the valleys and over this ridge to get to the east. Now, the two principal points in this part of the country are these two—the Peak, in Derbyshire, and the Holm Ridge—which continue along here at a lower elevation, and the mountain land extends in that direction so as to cut off all other access. The rainy winds come up the valley of the Mersey, and so up towards the district where the Woodhead reservoir is, where all the supplies are obtained for Manchester on the one hand, and Dewsbury on the other near Woodhead and Calcotts. The sites of the reservoirs are both very good. The Blackmoor Foot is one of the most beautiful sights that you could see. The bottom of the reservoir would be upon a shale bed in the uppermost millstone grit, and the rock is quarried on the sides, and very good clay is obtained in the bed of the reservoir from the decomposition of the shale which is there. I think the average rainfall of the district may be taken at 42 inches. The Scope gauge is limited to the district drainage area of Brow Grains Dyke, which is about 970 acres down to the gauge. I have seen the pipe spoken of as having been put by the Meltham people, and I confirm the evidence already given in respect to it. About 186 acres will be drained by this pipe. I think the millowners will be gainers by the scheme. I agree with Mr. Hawksley and Mr. Glaisher that to be certain as to the accuracy of the gauges there must be at least five years observation.

Mr. Somerset was about to call other evidence, when

The Chairman stated that, as the cross-examination of witnesses seemed directed principally to the question of compensation, it might save time and repetition of matter if the parties agreed to proceed to finish the case as far as the preamble of the bill was concerned, reserving until the clauses came on all evidence which related to compensation.

After a brief discussion,

Mr. Somerset said that after the suggestion of the committee he would at once close the case for the promoters of the bill, reserving, of course, the right to call witnesses upon clauses.

Mr. Stephen stated that it might save the time of the committee, and possibly prevent the necessity of their hearing him on behalf of his clients, if a short time were allowed for negotiations between the parties.

After an interval of about five minutes,

Mr. Stephen said that certain proposals had been made to him and his clients which they had not fully considered or determined upon, and therefore he should have to trouble the committee with some observations in support of his case. There were three separate and distinct objections, he said, to the proposals made by the Huddersfield Water-Works Company, and which went against the principle of their bill. He thought he did them no injustice when he said that by their bill they proposed to take the whole of the water of the Brow Grains Dyke, and the drainage which ran into it, from the Meltham area, and to carry it by the catch-water drain to their new reservoir, a certain portion of which, however, would be returned to the millowners as compensation; but upon the face of that proposal, he did not hesitate to say that it was one which ought not to be entertained, because it was a proposal distinctly to deprive the local board of Meltham of the powers which had been conferred upon them by a general Act, and which it would be impossible for them to exercise if the Huddersfield Company were to take their place. He need not refer to the special provisions with regard to this subject, because the committee were doubtless aware that under the Public Health Act of 1848 they were entrusted with the supply of water to the district in which they existed; and under those circumstances, they had a right to give such a supply, and to superintend all sanitary matters which the Act prescribed. The very essence of the scheme was to deprive the local board of the power of doing that, because it would enable the Huddersfield Company to take the catchment from which they derived their supply, and apply the water to the purposes of their scheme. The consequence would be, that great injury would follow to the people of Meltham. The scheme, he submitted, was contrary to principle, because it intended to overrule and repeal a general statute by a private Act of the Huddersfield Water-Works Company. A very short examination of the facts already in evidence would show the committee the hardship which would be inflicted upon the people of Meltham if the bill was allowed to pass into law. He pointed out the actual position of the Meltham Local Board with regard to this matter. It was a place increasing in size, and the formation of a railway now in progress would add considerably to its importance. The local board, which was formed in 1860, felt it to be their duty to construct a small reservoir for supplying the town and district with water, and to do everything they could in this respect to benefit the inhabitants. Like most other companies they felt the want of an adequate quantity of water in dry summers, and this made them sensible of the fact that they were outgrowing their supply, and that a greater quantity would be necessary for their purpose. Shortly after last summer they began to cast about for means to increase their supply, and under the powers conferred upon them they proceeded to the Secretary of State, and obtained official sanction to borrow money for that purpose. They then proposed an addition to their undertaking, the supply for which was to come from the Scope spring, as had been stated. The Huddersfield Water-Works Company, no doubt, also had the experience of a dry summer, and wished on the same account to extend their area, but Meltham did not wait to see what they proposed to do before they took steps on their own account. They had heard it said by those in favour of the promoters that water had been stolen from behind their backs, and that certain pipes had been laid down by his clients, thus insinuating that something had been improperly done by them, and that they were poaching upon their rights in a manner which the Meltham people ought not to do; but the plain answer to all these observations was, that his clients wanted more water and more money, and accordingly made arrangements with the landowners, and then it was they found that Huddersfield was coming into their territory with the intention of supplying the whole of the district which lay within the jurisdiction of their board. This, then, was the general position of the two parties. He ventured to think that the bill was calculated to take from them some of the most important powers which they possessed. It showed considerable harshness, too, because they were able to supply themselves much cheaper than any one else could do for them. The promoters proposed to carry the Meltham water all the way to Huddersfield, and then to send it back to them, instead of allowing them to take it from the Scope spring direct to their town. And then they were not to be charged at a rate the same as the Huddersfield people were, but they were to pay 25 per cent. in addition, though Mr. Hawksley himself had admitted that they ought to be placed on the same footing as Huddersfield. It was obvious that the various local boards around Huddersfield were in point of fact compelled, from difficulty of getting water, to become parts of that borough; but such was not the case with Meltham, and it was very hard upon them that they who could get water, and did not want the assistance of Huddersfield, should be compelled to be annexed to them against their will, and to get their water at an increased expense. Already they were rated for the sums expended in the construction of the reservoir, and for the service of the pipes; they wished, therefore, to remain as they were, so that they might extend the area of their supply themselves. They could not supply, it was true, all the houses in the district, but they proposed to supply very nearly all which were under the Public Health Act. Out of 544 houses, 482 were under £5 rental, and those they proposed to serve at 2s. in the pound on the rateable value, so that the highest rate which would be charged to them would be 10s. per annum. What the promoters evidently wanted was, to be able to extend their works in such a way as that they would contribute greatly to the benefit of Huddersfield, but with which the people of Meltham had no concern whatever. In fact, the promoters were selling to Meltham their own water at a higher rate than they were paying for it themselves, in order that with the profits they (the promoters) might beautify their town, and so reduce their rates and local burthens. Out of the 544 houses which Meltham proposed to

supply, there was only one of £50 rateable value, and that house would have to pay, according to their (the Meltham) scheme, £5 a year for water, whilst under the Huddersfield proposal the payment would be nearly £8. He mentioned this in elucidation of the hardship which would be entailed upon Meltham if the bill was allowed to pass into law. Not only would they be deprived of their rights and privileges of supplying houses with water from the works which they had constructed, but they were to be saddled with great expense in addition; and it was against these things, therefore, they were ready to fight to the utmost of their power. He would submit, in conclusion, that it was not desirable the corporation should have those extended powers which they proposed to take by the bill, but that the Meltham people should be left, if possible, in the enjoyment of those rights and privileges which Parliament in its wisdom had given them.

Mr. *E. C. Gooday*, examined by Mr. HOLKER.

I am the chairman of the Meltham Local Board. The district of the local board is coextensive with the township, which numbers a population of 4400 persons. A branch line of railway is now forming from Meltham to Huddersfield, and when that is opened we anticipate a large increase in the population. Soon after the local board was formed in 1861 they proceeded to procure a water supply for a portion of the district. A small reservoir was constructed, and pipes laid down; 193 houses, at not more than £5 rental, and 49 above £5 rental, are now supplied by the board. In 1868 we experienced a very great need of water. It was then arranged that an additional supply of water should be obtained, and that the limits of supply should be extended to the whole of the township, as near as possible. We obtained a temporary supply in July last. In October it was arranged to take a pipe or a drain from the Scope springs, to obtain a better supply, and another from Clarke's springs. At present we have three pipes or feeders at the Scope, and not four, as stated. We have also a pipe from the Fairwork springs. We have a rate of 1s. 9d. in the pound to raise a fund, to pay the costs of the works and interest in 30 years. Besides that we have a water-rate of 3d. in the pound on the rateable value of the tenement supplied. We shall supply 556 houses when our district is extended. There are 21 of not more than £1 per house, and some are as low as 8s., and of this sum the tenants of separate rooms will pay their equal proportion. The rate altogether would bring in about £156 2s. If those houses were rated according to the schedule in the bill, the amount would be £301 5s., but the Huddersfield charge is to be on the rental, which makes about 20 per cent. additional. On the rateable value it would be £301 5s., and in the nature of a perpetual charge. Our £156 would only last 30 years, until the cost of the works was liquidated. We have 20 houses at £6 or under, the rate upon which would be £12, as against the Huddersfield £15; and four at £7, rated at £2 16s., as against the Huddersfield £3 10s. The result is that those houses would be charged £170 more per annum by the Huddersfield scheme than by ours, and the charge would be, as I have said, in perpetuity, whilst, at the end of 30 years, our debt would be paid, and we should have but a 3d. or a 6d. rate at the outside. The rateable value of our township is £10,800. There is a very strong feeling in favour of the local board widening the supply. The difference in the Huddersfield rates and their own on the extended district would be £165. We owe £1100, which we are reducing. We have obtained the authority of the Secretary of State to borrow the requisite money (£3000) for the extended supply. The Brow Grains Dyke is much fouled in summer. It becomes a nuisance at times from the refuse which is turned out from the mills. We had no water to flush it during last July and August. Floods certainly are of great use in flushing it. From my knowledge of the state of the stream last year I think that, even supposing compensation water is sent down to us in a regular flow, the dyke would be a continuous nuisance instead of an intermittent one. I do not think that a compensation supply of 7 inches coming down regularly would be sufficient to clear out the stream and flush it. They want a "pash," as they call it in Yorkshire; the water coming down suddenly washes the stream, and in the other case it would be a gentle flow. We want a moderate flood, in fact.

Cross-examined by Mr. SOMERSET: During some portions of last summer the quantity of water coming down the Brow Grains Dyke was unquestionably less than 400 gallons per minute. You agreed to clauses in 1866 which are not in this bill, and that is one reason why we oppose. When we gave our engineer instructions to lay down the pipe there was a popular rumour that Huddersfield was promoting a scheme, but there was nothing definite. There were no reports in the newspapers, and everything apparently was kept as quiet as possible. I do not see why we should be called upon to pay a sinking-fund for the construction of the works three miles away from us, and to bring the water back to us, when we can construct so much more simple works ourselves, and which we have the power to do. [Tables were put in showing a comparison between the different charges at Meltham and Huddersfield.] We have no idea of draining the 186 acres alluded to, but only 4 acres. The 186 was entirely put into our head by your own witnesses. The mills lie outside our district of supply.

Mr. *J. Sykes*, examined by Mr. STEPHEN.

I am a farmer, living at Helmer Meltham, near Huddersfield. In 1860 we were badly off for water, and in consequence of this we made the existing reservoir and works connected with it. We borrowed £1500 for that purpose. An increase in the supply has been under consideration for some time, and in July or August we took steps to accomplish that object by putting in a pipe to the Scope.

Mr. *J. B. Abbey*, examined by Mr. STEPHEN.

I am a land surveyor in Huddersfield, and partner to Mr. Abbey who was called on the other side. I constructed the reservoir at Meltham, and in October I was instructed to make surveys and prepare plans for an additional reservoir, and to ascertain whether the Scope and Clarke's springs could be made available. The new reservoir was to contain 2½ million gallons, and was to be constructed on the south side of the present one. A pipe was to connect it with the Scope spring, to take simply what water there was under the surface. The surface water would flow down into the Brow Grains Dyke, as usual. The pipe has three mouths, one of which is 8 inches in diameter. There are two branches from the main conduit of 6 inches in diameter. It is from 3 to 9 feet underground, varying according to the nature of the ground. The pipes simply collect the water from the spring underneath the surface; there is no well or anything. The surface water all returns. The inclination of the pipe varies. The slightest gradient is about 1 in 126. The distance from the reservoir to the mouth of the pipe is about 1500 yards. The lower portion of the pipe is constructed to bear pressure. There are four or five aqueducts put on a conduit to carry the streams across in the proper channel. In my judgment the water coming down the pipe would be required for the supply of the Meltham water district. It would take six months to carry out the works, as far as the reservoir is concerned. The service-pipe would require a little more time—about nine months.

Cross-examined by Mr. SOMERSET: My estimate for the new reservoir and pipes is £2427. The old reservoir contains 800,000 gallons. We propose to supply 20 gallons per head or 60,000 gallons per day. The present supply is at the rate of 20 gallons. There is about 32 days supply at present.

The COMMITTEE inquired whether any negotiation was going forward as to a settlement.

Mr. SOMERSET stated that the evidence which had been given by Mr. Hawksley contained, in substance, the proposals which the promoters were prepared to make.

Mr. STEPHEN stated that a proposition had been made to him on the subject shortly before the committee sat that morning, and that he had not had time to take it into consideration. He had called his witnesses, and had nothing more to say to the committee.

Mr. HIGGINS, on behalf of the millowners on the Meltham stream, said that he could not enter into any negotiations with the promoters at all, and that he must resist the preamble of the bill in every way.

The CHAIRMAN said the learned counsel had better proceed with his case.

Mr. *Glaisher* recalled, and examined by the COMMITTEE.

The rainfall at the Scope gauge, in the two years that I gave, I have marked down at 48 inches. When I spoke of 42 inches as the average for the whole district, I spoke of 48 inches as being the average of that particular spot, making the observation at the time with reference to that which had the limited area around it. The Standedge gauge for 17 years has given 50 inches.

By Mr. HIGGINS: The 48 inches is the amount of rain that would fall on that gauge for many years at that particular spot. 1868 was not a dry year. It was dry in the middle part of the year, but, taking it as a whole, it was a wet year in every part of the country. 1867 was rather a dry year. 1866 was a very wet year. Standedge then gave 69 inches.

Mr. HIGGINS then opened the case on behalf of the millowners. He confessed that he did not enter upon his case with any hope of success, because all must have seen the direction of mind which the committee had taken upon the subject; but, inasmuch as he was instructed to oppose the preamble of the bill, it was his duty to place before the committee such reasons as had occurred to him, in order to justify him in the course which he had taken. The inquiry was not at all an amusing or edifying one, and therefore he intended to be as brief as possible in the remarks which he had to make in support of the petition presented by his clients. The learned gentleman then proceeded to say that the corporation, having only gained their charter in July, 1868, had not had time to come before Parliament with a matured scheme, and it had been suggested that they had been obliged to omit a large and important part, which ought to have been included in their bill; therefore he thought they might take it that they came there with a very small, a very lame, scheme indeed, and that they would be compelled to supplement it by reappearing before Parliament in a very short time. The corporation, in his opinion, might very well have delayed their application till next session, for then they would have been in a better position to select a more suitable drainage area than the one they proposed to take, and which, if the millowners were to receive anything like justice, would be inadequate to supply the district of Huddersfield with what water might be required. They proposed to supply a district with a population of something like 100,000 with water both for domestic and trading purposes. Now, the millowners whom he represented protested against the corporation being allowed to take the water, and to sell it for trading purposes, which they would do at a very considerable profit, and in ease of the ratepayers of the town. Mr. Hawksley had drawn the line at the brewers and small traders of the town—persons who required a limited supply—but this, he ventured to think, would not be all the supply which the corporation would be disposed to give for the purposes of trade. The millowners said that the promoters ought not to be allowed to come into their valley at all. The water from 1000 acres at present drained into the Meltham stream, and, there being on that stream 21 mills already, the water was sufficiently taken up by them; indeed, there was none to spare. He maintained that the promoters had failed to give adequate reasons why they should invade the valley, and he prayed that the committee would decide that the preamble of the bill had not been proved. It was not as if the mills had a surplus of water, or water running to waste; but he should show that in some seasons of the year they had no more than they required for manufacturing purposes. Not only did they require water in the daytime, but in a great many instances they used it during the night, especially when the fulling stock machinery was at work. The promoters proposed to intercept the whole of the water which at present flowed to their mills, and therefore a serious injustice would be inflicted upon them, especially as no amount of compensation which could be given by the corporation would meet the requirements of their case. He should produce evidence to show that the water falling upon the district had not been correctly stated, and that some of the calculations of the rain-gauges were such as could not be relied on. He maintained that 7 inches was far too small an amount of compensation to be given to the millowners. Mr. Hawksley had said that if 9 inches were given it would be fatal to the measure, and what then were they to expect. He should show that, according to the rainfall of the district, the millowners were clearly entitled to 10 inches, and he would prove this by evidence of a scientific character. He thought that 14 inches, as stated by Mr. Hawksley, was too much to be deducted for evaporation, the quantity varying according to the geological and physical condition of the country. However, making a fair deduction for evaporation, the amount registered by the Scope gauge and the stream-gauge would be corroborated, and it would be shown that the rain-gauge of the millowners did actually register the quantity of rain which flowed down the stream. If he showed that the rain-gauge corroborated the stream-gauge, and that Mr. Hawksley's quantity of water was fallacious, then the promoters would in that respect be out of court entirely when they proposed to give the millowners an equivalent to the extent of 7 inches only for the water which they now obtained.

WEDNESDAY, APRIL 28.

Mr. *J. Ramsden*, examined by Mr. HERSCHELL.

I am the owner of the New Bridge mill, the first mill on the Brow Grains Dyke below the proposed works of the Huddersfield Corporation. We use a small condensing engine as an auxiliary to the water power. A large storeage reservoir is connected with the mill. We can store about 773,000 gallons. If we had an uninterrupted flow of 7 inches, as suggested by the promoters, we should have to use our steam-engine from morning till night.

By the COMMITTEE: In ordinary years we can run eight months by water. We have not sufficient steam power.

By Mr. HERSCHELL: Seven inches would not be sufficient power to turn our water-wheel at all, or so as to work our machinery. We should require something like 10,000 or 15,000 gallons a day for washing, dyeing, and scouring. The scheme will prejudicially affect our business, and cause us great extra expense.

Cross-examined by Mr. SOMERSET: I am not aware that Mr. Hawksley said we could have that compensation which was most convenient to ourselves. That would not obviate our objection. There would not be enough, even if it were to run night and day.

By the COMMITTEE: It would take between 3000 and 4000 gallons a day to work our mill. We get this quantity regularly down the river.

By Mr. SOMERSET: For four or five months in the year 1868 there might not have been 400 gallons per minute coming down the stream.

Re-examined by Mr. HIGGINS: We should require 3000 or 4000 gallons per minute of water power, and the other quantity—10,000 or 15,000—we should use for washing, dyeing, and scouring purposes.

Mr. *J. Kilburn*, examined by Mr. HIGGINS.

I live at Meltham, and am one of the petitioners. I am an ironfounder, engineer, and millwright. All the mills below the junction of the Royd Edge Clough and Brow Grains Dyke down to Step's mill are dependent on the water of those two streams. They all require water for washing purposes. I should say that the second mill would require 4000 gallons per minute. The compensation water proposed by the bill is 992 gallons, which is not at all sufficient.

Cross-examined by Mr. SOMERSET: I think that for those mills to have a steam-engine and a water power combined an irregular supply is much preferable to the proposed compensation, even supposing it were a regular supply. It depends, of course, on the quantity of the regular supply. I prefer an irregular supply when I can utilize the maximum, with the exception of large floods, to a regular supply when that is the minimum supply. I prefer the present state of things to the state proposed by the bill.

E. Hoyle, examined by Mr. HERSCHELL.

I am an engine tenter in the employ of Mr. Ramsden. We work with water for eight months in the year; during the remainder we use steam and water together.

Cross-examined by Mr. SOMERSET: I took the gaugings at the millowners gauge. Somebody else put them down, because I am no scholar.

Mr. *Eli Mallinson*, examined by Mr. HIGGINS.

I am in partnership with my father as a cotton manufacturer at the Hoyle House Clough mill. We are petitioners against the bill. The mill is six storeys high. We have a warehouse, a dye-house, a gas-works, and other buildings. The water has always continue to flow in its natural course towards the river Colne. The mill is about a mile from the intended reservoir, at the bottom of a deep ravine, or gorge. I am told that the fall between the reservoir and our mill is 400 feet. In the event of the reservoir bursting, I suppose we should all be swept away. We have always had a sufficient quantity of water coming down the stream for the requirements of the mill, except for a very short time last summer. I believe we shall suffer seriously if the bill is passed by the committee. The catchment area is 309 acres, and that is proposed to be taken from us. Mr. Hawksley, in 1866, admitted that we were fairly entitled to compensation the same as the other millowners were.

Cross-examined by Mr. SOMERSET: I should say that 216 gallons is not enough. I should be surprised to find that, taking everything, winter and summer, in 1867—that is to say, the floods and all—the average was only 208 gallons per minute. We took Mr. Hawksley's word that whatever the Meltham people were entitled to we should have the same *pro ratâ*, and we rested entirely on that.

Mr. *Joseph Taylor*, examined by Mr. HERSCHELL.

I am the registrar of births and deaths at Meltham. I have been employed by the Meltham millowners in taking certain gauges. I attended to the stream-gauge up to the 30th of April, 1866. The other gaugings were taken afterwards by Mr. Halstead.

Cross-examined by Mr. SOMERSET: I took the gaugings myself, but did not calculate them. I measured them in a glass. I took the rain-gauge to the present time. [A table showing the rainfall at the Scope gauge was handed in.]

John Newton, Esq., examined by Mr. HIGGINS.

I am a civil engineer, in partnership with Mr. Cawley, M.P. I produce the gaugings of the stream-gauge in the valley down which the Brow Grains Dyke flows, and the catchment. The calculations were made under my superintendence.

Mr. *W. Halstead*, examined by Mr. HIGGINS.

I work at the New Brodie mill. I had the measurements from the witness Hoyle, which are correct. I do not know whether he can read or write; he can read figures on the rule. He used to come and tell me what the gaugings were, and I put them in a book. The distance from the gauge to the mill is 300 or 400 yards.

Mr. *J. Newton* recalled, and examined by Mr. HIGGINS.

The stream-gauge is properly placed for the purpose of gauging. The water flowing from the 850 acres passes through the stream-gauge. In 1866 the quantity of water which went over that gauge was 178,056,125 cubic feet; in 1867, it was 146,722,267; in 1866, 144,066,480. The rainfall at the Scope gauge in 1866 was 69·81 inches. In 1867 the stream-gauge registered 75·64 inches; the rain-gauge at the Scope registered in the same year 54·30 inches. In 1868 the stream-gauge registered 46·83 inches, whilst the Scope gauge registered 59·34 inches. The difference between the rainflow and the rainfall on those three years is 10½ inches per annum, and it is a fair quantity. The average for five years over the stream-gauge is 50·66 inches, and 61·15 inches of rainfall; 850 acres are drained by the stream-gauge. The 10½ inches would be due to evaporation. If we adopt Mr. Hawksley's principle for compensation, it would stand thus—average on the three years, 61·15 inches; that is above the general average of a long period. From that I take off 14 per cent.; that brings us to 52½ inches. If we adopt Mr. Hawksley's one-sixth for floods, that is 8½ inches, that leaves us 44 inches. If we take off also 14 inches for evaporation, that leaves 30 inches, and one-third of 30 inches is 10 inches. I think that is the very lowest quantity of compensation water which the millowners ought to have. Our gaugings have often been taken five and seven times in a day. A gauging taken once a fortnight shows nothing; it is quite fallacious. We have made 1574 observations in the two years, 1867 and 1868. I cannot see the principle of Mr. Hawksley's taking off one-sixth after having ascertained the gross rainfall. I would rather take it thus, that whatever a man uses now he is entitled to be compensated for. I am inclined to think that Mr. Hawksley takes off rather too much for evaporation; it appears to me to be so from the stream gaugings.

Cross-examined by Mr. SOMERSET: With regard to the gaugings, I have got 94,000 gallons for February 1, 1868, at eight A.M. At nine o'clock the gallons might be 56,000; at ten, 23,000; at twelve, 17,000; and at four, 10,000. At five o'clock on the night of the 31st of January, 1868, it was 1036 gallons, whilst at eight o'clock on the same day it was 1142 gallons. If the millowners had 90,000 gallons per minute coming by, they could get no benefit from it at a particular time; they could merely get their wheel full, and nothing more. They could not hold it back; it would flow past them. I say the gaugings of the promoters are fallacious, because they were only taken once a fortnight. I illustrate that by saying that one day these gaugings showed 4500 gallons, and there was nothing to show what it was the following day; but we have information which shows that it was 94,000 gallons.

The COMMITTEE: Of course it is open to that uncertainty if you take it only occasionally; there may be a storm the day after you take it.

Mr. SOMERSET: Then your view is that Mr. Hawksley, Mr. Glaisher, and all these gentlemen we have called are wrong in the way they divide by six and take off 14 inches?

Witness: I do not think that is a fair way of taking it. I think the way to take it is by what a man does actually use.

Mr. SOMERSET: We will take the evidence of the witness who said that Mr. Ramsden's mill required 3160 gallons per minute to turn it.

The CHAIRMAN: I think he said that it would *bear* that.

Mr. SOMERSET: He said it would require it. If that quantity only runs for 34 days in the year, how should you take the compensation?

Witness: If 3160 gallons only ran, you mean?

Mr. SOMERSET: Supposing that quantity only comes down 34 days in the year, upon what principle would you take the compensation?

Witness: I would ascertain the number of days on which he has sufficient water to work his wheel entirely without steam, when there is abundance of water to work his wheel.

Mr. SOMERSET: Taking it from me at 34 days, supposing he could only get water to use his wheel during 34 days, what is the principle you would take for compensation?

Witness: The principle is that he ought in future to have that same quantity of water for 34 days.

Mr. SOMERSET: And do without the rest of the year?

Witness: He ought to have as much as he now gets.

Mr. SOMERSET: What is Huddersfield to do then, or what is any town to do, if the millowner is to take all he can get, being less than that? If for 365 days he takes all the water, how is any town to be supplied with water?

Witness: I should say that you ought to take first of all the flood water that we do not use, and secondly the night water that we do not use. This you might take without injuring us; and then all that we now get we should have in equal quantities subsequently. If there is any difference I would prefer the irregular supply.

By the COMMITTEE: Assuming Mr. Hawksley is right in his area, it would make the evaporation 18 inches upon the ground, instead of 10½ inches as I have stated.

J. F. Bateman, Esq., examined by Mr. HERSCHELL.

I am a civil engineer and a Fellow of the Royal Society. I am engineer to the Manchester and other water-works of that district. I have been a close observer of the rainfall for the last 30 years across the Permian chain of hills. I am well acquainted with the Huddersfield district; I was the first to establish a series of gauges across this portion of the range, for the purpose of ascertaining the fall of rain on either side of the summit of the ridge, believing that the observations which were recorded by Dr. Dalton, having been communicated to him by the Rochdale Canal Company, were erroneous. I have been in the habit of comparing the rainfall with the stream-gauges. I may say that I am engineer to the Manchester Water-Works, to the Dewsbury Water-Works, and the Holme Reservoir Commissioners. All the drainage of those works joins the drainage, or rather is closely contiguous to the drainage, now under consideration, and I am also engineer to the Halifax Water-Works, which are a little north of it, and upon all those districts, or nearly all, I have not only the rain returns for many years, but the actual flow of water from the ground. I believe I have more accurate information upon this subject than any other man. I think the Brow Grains Dyke yields more water in proportion to the area than most others in the range. If you take the mean of three gauges which are in the valley of Longdendale, the valley in which the Manchester works are constructed, we have to add about 10 per cent. to those gauges to show the whole average to the Manchester Water-Works district, and that is a trifle more than the Woodhead gauge, to the east of the Manchester drainage-ground. I know also, from actual measurements, the quantity of water, every drop having been measured, which has been yielded during the last five years—from 1864 to 1868 inclusive. Those years were very useful to water engineers, because 1864 and 1865 were two of the driest years consecutively of which we have any record, and 1868 was a very peculiar year, in consequence of the extraordinary drought which occurred within it; 1867 was also a peculiar year, in consequence of the uniform fall of rain. It fell in every month of that year in such a way as to keep up a constant flow in the streams beyond what is usually the case. Now, the mean rain at Woodhead for 14 years is 49·68 inches. The mean rain of 1866, 1867, and 1868 is 58 inches, and I take those years because those are the years in which, at the rain-gauge at Scope, in the Meltham district, observations have been made. But before I go to those, I may say that the mean rain being 49·68 inches for 14 years at Woodhead, and the mean of the three last years being 58 inches, those three last years upon the mean were 8½ inches in excess of the mean quantity of the last 14 years; that is, exactly one-seventh. The Scope rain-gauge upon the mean of the same three years was 61 inches; if you deduct one-seventh from that, in order to bring it to the mean which is intended by the Manchester gauge, it leaves 52·3 inches as the mean produce of 14 years, being 2·62, or almost exactly 5 per cent. in excess of the Manchester Woodhead gauge. The Woodhead gauge, being a little less than what I believe to be the mean rainfall of the whole district, it follows that the rainfall registered by the Scope gauge in the Meltham district and the rainfall in the Manchester district are the same. The mean rainfall reduced in that manner, which is consistent with the experience of Manchester, would leave the mean rainfall at Scope 52·3 inches. Now, to go on to another point, in order to show the carefulness with which these things have been worked out, I can show that in 1868 the rain in Manchester, according to the Woodhead gauge, was 53·62 inches; in Meltham it was 59½ inches. The water which actually flowed off the ground in Manchester was 41½ inches, showing a loss of 12 inches. At Meltham the actual stream measurements in 1868 showed 48½ inches, taking the 850 acres of drainage as contributing water to the gauge by the measurement which has been taken by Mr. Newton. The rain being 59½, that showed a loss of 11 inches. I think that 12 inches is a full allowance for the amount of loss; it is generally less than that. It was 10½ inches in Liverpool.

Mr. SOMERSET: I am told that 10½ inches is wrong.

Witness: I took it from Mr. Duncan's (the late engineer to the water-works) tabulated results, which are published in his reports to the Liverpool Corporation, and given in great detail. It is 10½ or 11 inches.

Mr. SOMERSET: Mr. Hawksley says that that calculation is wrong.

Witness: It was not proved to be wrong. The average loss in Liverpool, according to this return [produced] was 11½ inches. My impression was that it was 11 inches; 11·22 was the exact figure over the years 1861, 1862, 1863, 1864, and 1865. Taking the Manchester rainfall at the mean of the valley gauges, and adding 10 per cent. in 1864, the rainfall was 45 inches. The quantity collected, or what flowed off the ground, or was measured as flowing off the ground, was 34·94 inches, the loss being 14 inches. In 1865 the rainfall was 41½ inches, the quantity flowing off the ground was 32½ inches, the loss being 9 inches. In 1866 the rainfall was 65½ inches, the

quantity which flowed off the ground was 54·13 inches, and the loss was 11⅛ inches. In 1867 the rainfall was 56½ inches, that which flowed off the ground was 48⅝ inches, and the loss was 7½ inches. In 1868 the rainfall was 53¼ inches, that which flowed off the ground was 41½ inches, and the loss was 12 inches.

By Mr. HERSCHELL: The loss by evaporation is very often less when there is a greater amount of rainfall, and consistently so, because the evaporation depends upon the capacity of the air for absorbing water, and when it is raining heavily there is no absorption. The water then is being precipitated, not absorbed. Dry air will absorb water very rapidly, but damp air precipitates it.

By the COMMITTEE: The loss by evaporation at the Manchester ground on the average of years was 11 inches.

Mr. HERSCHELL: Does that comparison which you have made between this ground and the Manchester ground as to evaporation, in your judgment, confirm what Mr. Newton has stated, that what flows into the stream flows from 850 acres, and not the large quantity mentioned by Mr. Hawksley?

Witness: It does. There is no reason why the loss should be greater here than in the Manchester works; on the contrary, there is a reason why it should be somewhat less. The next point to which I beg to refer is the dry weather volume of the stream. Streams vary a good deal as to their actual volume in dry weather, and it is the constancy of the stream in dry weather which more especially confers an advantage upon the millowners. In Manchester, which I have shown may be taken as a fair criterion with respect to rainfall, the average volume of the streams during June and July, 1868, was 51 cubic feet per second for each 1000 acres. The average of the same number of days in June and July at Meltham was 64—as nearly as possible 50 per cent. more than the Manchester stream yielded. The minimum flow during the drought was at Manchester ·329; that is just one-third of a cubic foot per second. At Meltham it was ·56—about 60 per cent. The mean flow at Manchester during 150 days of drought, from May to October, was ·776 of a cubic foot per second for each 1000 acres. At Meltham it was just 1 cubic foot per second—1·03—being there an excess of nearly 50 per cent. One foot per second, flowing from 850 acres per second, is exactly equivalent to a rate of flow of 9 inches per annum—more than it is proposed to give as compensation to the millowners, who had that quantity of water during 150 days of last year's extraordinary drought. The quantity of water flowing down the Brow Grains Dyke is unusually large in proportion to the drainage area. The Longdendale district of the Manchester Water-Works is a district yielding a very large proportion of spring water—much more than is usually yielded by a millstone grit district—and yet this district of Meltham is in excess of that district by 50 per cent. In the Halifax district the mean flow from the ground for June and July was exactly one-half of the Meltham district—·32 against ·64. The quantity of water which can be used by the first mill on the stream is a little under 8 cubic feet per second. The compensation which the millowners are satisfied with is 12 cubic feet, equal to 10 inches in respect of the 1400 acres which is now drained into the Brow Grains Dyke. If 10 inches were given as the uniform flow of water during the whole year, it would benefit them considerably during five months of the year, but they would lose power, and therefore be, to some extent, injured by it during the other six or seven months of the year.

By the COMMITTEE: It is proposed to be a continuous flow equal to 7 inches. I suppose they would have reservoirs which would enable them to hold a certain quantity of water equal to 3 cubic feet per second.

By Mr. HERSCHELL: 1868 was a very extraordinary year. Taking the whole year the quantity of rain which fell was above the average, but the drought was the most severe of which we have had any experience.

Mr. HERSCHELL: As to the question of compensation, do you agree with Mr. Hawksley that one-sixth should in all cases be deducted for the rainfall as the first step in calculating the compensation?

Witness: I do not; it is a rough approximation to the truth. It is tolerably correct in some cases, but incorrect with respect to others. The fairer and proper way—as rainfall does not depend upon any rule, but more upon physical conditions and exposure—is, if you can find records that are applicable to the district, to take the two driest years as they are recorded. Applying that to this particular case, where we have 14 years observations on the Manchester Water-Works, I take the years 1864 and 1865 as the two driest years. The mean of those two years, at the Woodhead gauge, is 41·9 inches. If you add 5 per cent. for the difference which exists between the rainfall at Woodhead gauge and that at the Scope, it makes it exactly 44 inches as the probable mean of the two driest years at Meltham. Then if you deduct 12 inches for loss, there will be 32 inches left. The actual produce of the Manchester district in those two years was 33½ inches, therefore you see how nearly the computation made in that way agrees with the fact. If I deducted only 10 inches, which was the actual loss, taking the Woodhead gauge as the criterion, it would leave 34 inches as the produce for the district at Meltham, compared with 33½ inches, which was the produce of the district at Manchester.

The COMMITTEE: Supposing the reservoirs were very large, taking it over a series of years, that figure of one-sixth would be diminished, would it not? Does it not depend upon the capacity of the reservoir?

Witness: Yes, entirely; it is a question of storeage. If you had storeage enough you could store the whole quantity passing down, if you never let a drop of water run to waste in floods. In 1864 and 1865 we had at Manchester about 24,000 cubic feet of storeage to each acre. By the scheme before you you will have about 45,000 cubic feet of storeage to each acre. With 24,000 feet of storeage we actually utilized, in 1864 and 1865, 23½ inches of water. At Huddersfield, with the storeage Mr. Hawksley has prepared, you can actually utilize 35 inches of water, and can supply it during any drought that may occur. He can supply it during a drought of 150 days even; he can, therefore, afford to give 10 inches to the mills, and would have 25 inches left for the supply of Huddersfield. The scheme is safe for 3 million gallons.

By Mr. HERSCHELL: I think that 10 inches is less rather than more than the compensation which the millowners ought to have. In Manchester, we did give 15 inches, but we purchased down to 11¼. In Halifax, we gave 10 inches out of a rainfall less than this. In Rochdale, 10 inches were given, the rainfall being a trifle less than Halifax. In Oldham, by a bill which has been thrown out this year, we proposed to give 10 inches to the mills, and at Ashton and Stalybridge the same quantity is to be given.

Cross-examined by Mr. SOMERSET: The Ashton and Stalybridge works are nearly completed. There is no supply as yet, but experience tells me what it will be. Halifax could not give compensation in 1864 and 1865, because with a quantity of water which is equivalent to less than 1½ million gallons a day they have been supplying the town with nearly 2 million. Like other spendthrifts they emptied their purse, and, of course, they had nothing to go on with. I am their engineer. Ten inches was too much compensation in that case. I cannot say how much money compensation had to be paid at Halifax. It was the fault of the corporation and not of the 10 inches. Still it was a little too much. I think that the compensation to millowners ought to depend partly upon the rainfall and partly upon the storeage. Where the principle has been acted upon, which has been hitherto established since 1847, when Mr. Hawksley got one-third in the Liverpool case, which was the starting of the proportion of one-third, the corporations and companies have been punished where they have had too small an amount of storeage. There is no difficulty in giving the compensation where the amount of storeage is sufficient; but there is great difficulty where it is insufficient. The number of days storeage varies with the district. In the Huddersfield district 150 days storeage would be sufficient, dealing with the produce of the streams. I never gave evidence in favour of 6½ inches as the amount of compensation to be given at Sheffield. By a bill which was obtained two or three years ago that amount of compensation was allowed at Sheffield, but I never gave evidence in favour of that. I have no hesitation in saying that it is a great deal too little; it was right for the original drainage of Sheffield, but it was erroneous for what they had when they got their Act two or three years ago. I agree with Mr. Hawksley and Mr. Glaisher that going east there is much less rainfall, after you get away from the foot of the hills. I know the Calcott gauge and the one at Ingbargeworth, about three miles to the east. There may be a difference in those gauges of 20 inches in three miles, and I wonder how the 3 per cent. for each additional foot of elevation applies there. I believe there is a difference of 100 feet in elevation between them.

Mr. SOMERSET: More than that, I think.

Witness: No; one is 900 feet, and the other 1000 feet high. If the rainfall is 38 inches at Ingbargeworth, then, if you add 3 per cent. for each 100 feet of elevation, you get about an inch more, so that that make it 39 inches. That ought to be the fall at Calcotts, according to the theoretical calculations we have heard; but, instead of being 39 inches there, it is 58 inches. That shows there is a difference, owing to other circumstances, and it shows also the absurdity of the calculation. Taking Mr. Hawksley's figure of 971 acres, the flow from the ground in 1868, instead of being 48⅛ inches, would be 42½ inches, which is just one-eighth difference. I have only taken 10 inches, which is not one-third of 35 inches; but, if the proportion of one-third of the water you can utilize were taken, it would be 11⅔ inches, instead of 10 inches. Mr. Hawksley can utilize 35 inches by the reservoirs he would have. I have no doubt that for five months last year there were not 300 gallons per minute flowing down the stream. It is to the advantage of the millowners to have a regular supply, no doubt. I apprehend no danger from the bursting of the reservoirs in these cases.

Re-examined by Mr. HIGGINS: When I say that a regular flow of water is preferable for a millowner to an irregular one, it would depend a good deal upon the watershed, and also upon the amount of irregularity in the flow of the stream. In this particular case, as I have shown, the volume is larger in dry weather than in most streams; therefore, there is greater constancy throughout the year, and the stream is, on that account, more valuable to the millowner.

Mr. SOMERSET: Does that mean that you prefer an irregular supply?

Witness: No. When I was answering you, I answered your abstract question by saying that a regular supply was preferable.

Mr. SOMERSET: I want to know, under the peculiar circumstances of this stream, whether you prefer a regular supply here?

Witness: No; I would rather have the irregular stream.

By Mr. HIGGINS: The compensation at Manchester at the present time is 11¼ inches. I do not think the same amount of water should be given to Messrs. Mallinson as to the others. There is not the same amount of rainfall there. I think that if 10 inches were given on the average of all the drainage area draining to Meltham, probably about 8 inches would be the amount to be given to Messrs. Mallinson.

By Mr. SOMERSET: The Manchester Corporation have paid a very large sum of money to get the compensation reduced from 15 to 11¼ inches. The millowners, with the aid of Mr. Hawksley, who was their engineer, got a very large amount of compensation; so much that they could not use the water, and we purchased 20 cubic feet out of 75, leaving the compensation now 55 cubic feet per second. The 75 cubic feet was equivalent to 15 inches of water off the whole of our drainage-ground. The compensation in 1867 arose in this way: we appropriated a certain district in the first Manchester scheme for the supply of Manchester only, and a certain other district for the supply of the mills, and upon that we made a compensation reservoir. Then they claimed the whole of the water which could be utilized by our works upon that appropriated district, and upon that compensation was given. It was not given by any quantity, but fixed at the higher amount.

THURSDAY, APRIL 29.

C. E. Cawley, Esq., M.P., examined by Mr. HIGGINS.

I am a civil engineer, and have had large experience in the construction of water-works. In 1865, when the former bill was promoted by the Huddersfield Water-Works Commissioners, I was consulted on the subject of the amount of compensation which ought to be given to the millowners. It was by my advice that the Scope rain-gauge was fixed. My experience from that time to this confirms me in saying that the millowners ought to receive as much compensation water as they can work their mills properly. The proposal contained in the bill is very much less than they ought to receive. The stream-gauge, taking an average of the last three years, showed that the millowners had had water to the extent of 13 inches, and that was the quantity of compensation water which they were entitled to in this bill. If 12 inches were given to the millowners in general, 8 inches would be sufficient for Messrs. Mallinson, as their mill was upon a somewhat different footing.

Mr. SOMERSET: Are you aware that for some months in the year the stream is perfectly dry?

Witness: It may have been so, but that does not alter the average quantity, if what I said had run down the stream during three years.

Mr. SOMERSET: Do you know that during 1867 the daily average of Mr. Mallinson's supply was only 208 gallons per minute?

Witness: That result was obtained in a most absurd and fallacious manner, because the gaugings on two occasions were taken a fortnight apart. That was an incorrect manner of obtaining the average flow down the stream. In order to thoroughly ascertain it, the gaugings must be taken many times during the day, and many times during the night, because the flow is so irregular.

J. G. Blackburn, Esq., examined by Mr. HERSCHELL.

I am a civil engineer, and the engineer to several corporations in Lancashire. I have had much experience in the question of water compensation. I am acquainted with the district included in this bill. Four years ago I examined it for the purpose of giving evidence before the committee. I agree with the evidence of Mr. Cawley. I think that the millowners ought to receive at least 10 inches of compensation water. Messrs. Mallinson are somewhat differently situated to the rest. Their available rainfall is only about 27 inches. They should have about 9 inches compensation, which would be quite sufficient for them.

Mr. HERSCHELL: What compensation has been given in the case of other towns.

Witness: At Ashton, Stalybridge, Oldham, and Rochdale, 10 inches was given, and at Glossop 9 inches.

Mr. SOMERSET: Now, I think that this is unfair, because no doubt there were special circumstances in connexion with each of those towns which induced Parliament to fix that number of inches.

Mr. HERSCHELL: Mr. Hawksley has told us in his evidence of towns that only 6 inches had to be given. Surely we have a right to give evidence on the other side of the question.

Witness: I believe the Meltham stream to be more productive than any of the streams which supply the towns just mentioned.

The CHAIRMAN: What was the 10 inches compensation of which you speak? Was it given continuously, or only during 12 hours of the day?

Witness: Continuously, I believe.

Mr. SOMERSET: Do you not know that at Sheffield the compensation was fixed at one-third of 20 inches?

Witness: I do not know.

Mr. SOMERSET: Is not the compensation at Bradford only 6 inches?

Witness: It may be so. I know nothing about Bradford.

Mr. HERSCHELL: We have other witnesses to the same effect, but I think I need not further detain the committee.

The CHAIRMAN: Certainly not.

Mr. HERSCHELL: Then this is the case of the millowners against the preamble of the bill.

Mr. FORSYTH said that he had a few observations to make on behalf of the Aire and Calder Navigation Company. If the water was taken away, the navigation would, of course, be greatly impeded. He maintained that the promoters ought to give a larger amount of compensation than was proposed in the bill.

The CHAIRMAN said that the committee could not hear the opposition of the Aire and Calder Navigation Company on the question of compensation.

Mr. FORSYTH said it had been decided that the navigation would not be hindered, because, although the corporation took the water, it was returned to the stream in the shape of sewage. He would show that it was imaginary and fallacious to think that the same quantity which was abstracted would find its way back into the Calder. There would be a large loss of water, no doubt, and therefore he submitted that he ought to be heard against the bill.

The COMMITTEE: We cannot argue the question that water must not be given to a town because it will be converted into sewage, and in that shape find its way back to a river.

Mr. FORSYTH: If I can show that it can be avoided, and that a larger amount of compensation can be given——

The CHAIRMAN: Now you are on the same point again.

Mr. FORSYTH: Surely I can speak to that. They say we get the water back again in the shape of sewage, and, in reply, I say that we do not. We get water in a vitiated state, no doubt, but not in the same quantity as was taken from us.

The room was then cleared, and on the readmission of the public,

The CHAIRMAN said: The committee are of opinion that the preamble is proved. They think that it would be exceedingly convenient if the pipe which has been laid by the Meltham Local Board should cease to exist, and some plan devised so that the water may go to the reservoir, and then be brought back to supply the valley. They believe it would be to the interests of both parties that some arrangement of this kind should be made.

Mr. FORSYTH said that the Meltham Local Board would not offer any opposition on clauses, whatever they might do in another place.

Mr. HIGGINS: I believe the millowners will follow the example.

The committee then proceeded to consider the clauses of the bill.

Mr. *J. Farrer*, surveyor, was called to prove the extent of the drainage area of the proposed works, which he said was 971 acres.

The committee allowed compensation to the extent of 863 gallons per minute to the millowners during working hours—namely, from six o'clock in the forenoon to six o'clock in the afternoon of every day except Saturday, and then from six o'clock to one o'clock in the afternoon; and there was a proviso to the effect that, if the Meltham Local Board ceased to take water from the drainage-ground which on the 30th of November, 1868, contributed water to the Brow Grains Dyke, then the amount of compensation is to be increased to 994 gallons per minute. The compensation to Messrs. Mallinson—namely, 218 gallons per minute—was allowed. Provisions for the protection of the water-works of the Meltham Local Board were sanctioned, as were also others for the erection of gauges.

(*Before Sir* H. WILLIAMSON, *Chairman; Mr.* RICHARDS, *Mr.* BARNETT, *and Mr.* J. P. HARDY.)

CLEVELAND WATER BILL.

WEDNESDAY, APRIL 28.

Mr. RODWELL, Q.C., and Mr. LITTLE appeared for the promoters; Mr. CALVERT, Q.C., for Mr. Linsfield, and Mr. PRICE for Mr. Petch, petitioners against the bill.

Mr. RODWELL said the bill was originally intended to embrace water and gas, but it was now limited merely to the supply of water. Its object was to provide a better supply of water for the villages of Skelton and Saltburn-by-the-Sea, in the district of Cleveland, and it was promoted by a company whose capital was £12,000. The promoters were all local parties, and the gentleman who was the largest shareholder in the undertaking, and who took the deepest interest in the matter, was Mr. Wharton, a large landed proprietor in the district, who lived at Skelton Castle. This scheme was not at all put forward as a commercial enterprise. No doubt the shareholders did not intend or expect to be at a loss by the undertaking, but at the same time the real object of the scheme was to supply with pure water a district which was not wholly without, but which at present was obliged to take water which was thoroughly bad, and unfitted for man or beast. Saltburn had a population of 1500, and was, he understood, every year becoming more attractive. It had hitherto been supplied by the North-Eastern Railway Company, but in the year 1866 a violent epidemic broke out, the details of which would be given by a medical gentleman, and that epidemic was attributed to the water supplied. The matter was then taken up by the Saltburn Improvement Commissioners, and they selected the place from which a supply of good water could be obtained, near the mill at Moorshome. The mill on the stream belonged to a gentleman of the name of Petch, and the property on one side of the stream belonged to Mr. Linsfield. The pipes were laid on to the point near the mill, and the water was turned on, when, without warning or remonstrance, Mr. Linsfield took proceedings in Chancery against them, and got an injunction; and they had, consequently, desisted taking their supply from the stream since that time. It was preposterous to contend that their taking the supply from the stream could in any way injure Mr. Linsfield. The average flow of water in this "beck" was 2 million gallons daily; the maximum was something like 37 millions, and the minimum was 526,000 gallons, and this minimum was in the excessive drought of last year. All that they would require would be from 75,000 to 100,000 gallons, which was an inappreciable quantity. With reference to Mr. Petch's opposition, he could not very well understand it, because they did not propose to take any water from the stream until after it had served his mill.

Mr. *Boddington*, examined by Mr. LITTLE.

I am a Fellow of the Royal College of Surgeons, practising near Birmingham, but previous to that I was in practice at Saltburn. In 1866 the water supply was obtained from the Skelton Beck. There is sewage going into that beck, and it interferes with the quality of the water for drinking purposes. There were many cases of illness arising from bad water. In 1866 there was an epidemic of typhoid fever, which was caused by bad water and bad drainage. I was so impressed with the insufficiency of the water that I made an application to the Saltburn Improvement Commissioners, and impressed upon them the importance of getting a supply. I did not analyze the water, but I am satisfied that such water should not be supplied to people. I am satisfied there is a public necessity for a better water supply.

Cross-examined by Mr. CALVERT: The water is taken from the beck opposite the village of Saltburn. The water is not brackish there. There are two streams that join under Saltburn. I have not analyzed the water. The epidemic commenced in the autumn of 1865, and lasted till January, 1866, and commenced again in the autumn of 1866, and continued till the beginning of 1867.

Mr. *Hamilton*, examined by Mr. RODWELL.

I reside at Saltburn, and am agent to Mr. Wharton, who has an estate of about 10,000 acres. I have known Saltburn for 17 years, and I know that the supply of water is very unsatisfactory. I am aware that a memorial was presented to the Improvement Commissioners, asking that immediate steps should be taken to give a supply of pure water. The residents of Saltburn applied to me on the subject. The manager of the commissioners applied to me to make a reservoir on the property of Mr. Wharton, two miles above the point where the stream was affected by the sewage, but there was some objection to having a reservoir in the middle of the ironstone mining operations. Mr. Wharton then offered £3000 to a scheme which would supply the district, and hence the adoption of the present scheme. We wanted to take the water from a point near Mr. Petch's mill. We wished to cross the land of Mr. Linsfield, but as he objected the pipes were laid on the other side, on ground belonging to Mr. Wharton, Mr. Petch, and Mr. Walker. The water was laid on, but had to be stopped in consequence of Mr. Linsfield threatening us with an injunction. Mr. Linsfield's estate consists of 280 acres, of which 218 are under cultivation. The rest is wood, and abuts on the stream, and there is only one access from his land to the stream. It is so steep that he cannot use it for watering his cattle. There is a pond near one of the houses on the estate. We shall do no injury whatever to Mr. Linsfield as regards stock. People might go to fish once in the stream, but they never went twice. We shall not affect in any way the supply of water to Mr. Petch's mill, the water that we take being the waste water.

Cross-examined by Mr. CALVERT: I am a director of the company promoting this bill. I believe that Mr. Linsfield has minerals under the ground at a depth of 45 feet below the level of the stream.

Mr. *Anderson*, examined by Mr. RODWELL.

I am engineer for this water scheme, and have had large experience as a water engineer. We do not propose to take a single pint of water that Mr. Petch can use, and the deposited plans show that we do not. The present water used by the people of Saltburn is not fit for human use. I know the position of Mr. Linsfield's land, and I do not think this scheme will do him any injury. The maximum of water coming down the stream is 38 million gallons per day after a flood. The lowest, in the drought of last summer, was 621,000 gallons, and the quantity we propose to take now is 75,000 gallons. I think the towns of Saltburn and Skelton will be annihilated if they do not get a better supply of water.

Mr. PRICE cross-examined the witness at length as to whether any water would be taken from the stream before leaving the mill-race, but witness maintained that none of the water would enter the company's pipes until after it had served the mill.

Cross-examined by Mr. CALVERT: There was objection to taking the water from Gisborne, because it contained an alum shale. All other available sources of water supply would not furnish a sufficient quantity. I will undertake to say that this pipe will not draw off all the water from Mr. Linsfield's estate. It will not take off 226 cubic feet per minute.

Mr. *Warton*, examined by Mr. RODWELL.

I am proprietor of the estate and castle of Skelton. There is very insufficient supply of water at Saltburn, and I have been a party to these proceedings. I cannot see that the bill will do Mr. Linsfield the slightest injury.

Cross-examined by Mr. PRICE: By the plans it appears that our pipe goes into the mill-race, but the sections show that it does not.

This concluded the case for the promoters.

Captain *Linsfield*, examined by Mr. CALVERT.

I am the owner of the manor of Moorshome. There are extensive minerals under this property, and I anticipate that they will be of great value. It is essential to the working of these minerals that the water should not be taken away. For the last six years my bailiff has sent the cattle frequently to the stream, and has also carted water from it to the farm-buildings. There is in the summer sufficient water to drive the mill. If this bill is passed, I fear that in the summer all the water will be taken away from my estate.

Mr. *Bartholomew*, examined by Mr. CALVERT.

I am an engineer, and have examined carefully the parliamentary plans of the proposed undertaking. The average flow of the stream is 2 million gallons per day, which is equal to 215 cubic feet per minute; and the minimum flow is 600,000 gallons, which is equal to 66⅔ cubic feet per minute. A 12-inch pipe would take off 256 cubic feet per minute, or 25,000 gallons per hour. Thus it would take off the whole average supply, and a great deal more than the minimum.

Cross-examined by Mr. RODWELL: My calculation is what the pipe would take off if it were always running.

The COMMITTEE suggested that some arrangement might be made, by which the company would agree never to take more than a certain quantity of water per day.

After some consultation, it was arranged that the supply of water to the company should be limited to 200,000 gallons per day, and a clause was introduced to carry out this arrangement.

The bill then passed the committee.

(*Before Mr.* LEVESON GOWER, *Chairman; Mr.* GRENVILLE SHIRLEY, *Dr.* PLAYFAIR, *and Mr.* BONHAM-CARTER (*Referee*).

ACCRINGTON GAS AND WATER BILL.

MONDAY, MAY 3.

Mr. CLERK, Q.C., and Mr. POPE, Q.C., were for the promoters; and Mr. WEBSTER, Q.C., for Messrs. Hargreaves, the petitioners against the bill.

Mr. CLERK: This is a bill to authorize the Accrington Gas and Water Works Company to supply the township of Oswaldthwistle with gas, to extend their water-works, and for other purposes. In the year 1841 a company was incorporated for the purpose of supplying gas and water within the limits defined in their Act of Incorporation, which Act was subsequently (in 1854) repealed, and the company were reincorporated by an Act passed in the session of that year by the name of the "Accrington Gas and Water Works Company," and authorized to construct and maintain gas and water works, and to supply the places mentioned in the Act. The population in 1841 was very small, £10,500 being all that was required to carry out the works. In 1854 the population of Old and New Accrington had considerably increased, and the demand for water was very much enlarged, and also the supply of gas; and between 1841 and 1854 the company erected a new reservoir, without, however, receiving any parliamentary power. That was sanctioned in 1854, and the capital was increased to £59,500, with borrowing powers for £15,000, and the limits for the supply of gas and water were considerably enlarged. Among the works which they were authorized to make under the Act of 1854 was a certain reservoir, to which your attention will be directed in the discussion which will take place. In 1863 the demand for gas and water was increased, and an Act was obtained to authorize the company to extend their gas and water works, and, amongst other things, to construct a reservoir known as the Mitchell House reservoir, in the township of Lower Booths, in the forest of Rossendale, in the county of Lancaster, and within the manor of Accrington New Hold. But when the company came to examine the site of that reservoir, they found that a far better situation for getting a foundation for the embankment higher up the stream could be obtained than that which had been sanctioned by Parliament in 1863. They then made arrangements to remove the site to Harwood Dean, and that is what is sought by this bill to be confirmed. The plan will explain what I have been talking about; and you will see, surrounded by a red line, the water supply district which was added in 1863. The supply district of 1854 is coloured pale blue, and a reservoir was authorized to be constructed; but it was found that it could be placed higher up the glen, and an arrangement was come to with the landowners for that purpose. With regard to that, there is no question raised in this room at all. You see also the Cliff River, where there is a small reservoir, which I believe will be used more for a storeage than a collecting ground; and it is proposed by the bill to sanction that work, as it has been constructed without parliamentary power being first obtained. I will, however, now turn to the Mitchell House reservoir. One is coloured blue, but the other, coloured red, describes the intended enlargement. It is intended to throw the red into the other reservoir. That work has not, although sanctioned, been completed, and the time for compulsory powers will expire in the month of June, 1870, and we now ask for an extension of the time; and, with regard to that, there is no objection on the part of the landowners or anybody else in Accrington. In 1863, when we took up this new district, our capital was increased to £160,000, with a borrowing power for £39,000. Therefore that gave us, added to what we had in 1841, 1854, and 1863, power to create capital in shares to the extent of £230,000, which, with a borrowing power of £54,600, will make our capital altogether £284,600. We have raised on our works in share capital and loans £147,056, which leaves us with a capital to be raised of £137,544. We ask for no fresh capital, because we have the power to raise it, and the same capital will be expended on the changed site. In Accrington, in 1851, the population was 10,370, and that increased in ten years to 17,688, being 75 per cent. on the population, and it has gone on increasing in the same ratio ever since. It has increased as much as 25,000 from 1861 up to the present time. The population we now supply in the whole district is 43,870, and if the population goes on increasing at the same rate in ten years time, the population will have increased to 70,000. I need hardly, however, state these things, because we are not asking for fresh powers, but simply the extension of time for the completion of the enlargement of the works. It will be necessary to complete all these reservoirs within a few years from this time. In 1858 the works which were completed were, to a considerable extent, not available for supplying water to the district. The puddle trench in the reservoir is defective, and until that is restored the Mitchell House reservoir will not give the supply contemplated under the Acts of 1854 and 1863. When I tell you that there is no objection from any landowner, I think you will agree with me that the bill ought to be sanctioned. The only opposition is from Messrs. George and Thomas Hargreaves, who are lessees of minerals in the neighbourhood of the Mitchell House reservoir. They are lessees, under His Grace the Duke of Buccleuch, of a large coal-field in the manors of Accrington, new and old, and over which the reservoir has been formed; and the petitioners state that they have laid out a large sum of money in plant for the purpose of getting the coal under the reservoir and the surrounding district. They say also that they have been put to great expense in enforcing their right and claim against the company. But the Legislature will protect them if they have any claim. All rights as regards minerals by the Act itself are reserved to owners, unless dug upon in the construction of the works. That is contained in clause 18 of the Water-Works Clauses Act, 1847. Again, the lessee is required to give the undertakers 30 days notice before they can commence working for minerals beneath or near the reservoir. The petitioners say that minerals were under the Mitchell House reservoir in 1854, and also in 1863, when the enlargement took place; but their rights were protected under the Act of 1847, and it gave them this present claim. If the petitioners workings come within 40 yards, they can call upon us to take their minerals on terms of arbitration; and if we do not give them an answer in 30 days, they can go on and work for the said minerals. This is the position in which we stand as regards Messrs. Hargreaves. How are they in the slightest degree affected by what we propose to do in this bill? If there are minerals, they can call upon us to buy them at our own risk if they cannot be worked without impairing the water-works; but if they are situate at such a depth below the surface that the reservoir may be constructed with safety, is it right that the lessees should come to us and say: "Buy these minerals"? We say: "No, go on and work; we do not believe there will exist any danger to the reservoir. Minerals have been worked for under reservoirs without any damage being incurred." Therefore, so that as to this question of working minerals, it appears to me that there is very little to be said, because, as far as we are concerned, we are only asking for an extension of the time given us by the Act of 1863. We looked, therefore, at the opposition of Messrs. Hargreaves as somewhat unreasonable. We have made a survey at one-third of a mile from the reservoir, and have bored down without arriving at coal. We found a spring of water, but no coal, and that was 180 feet below our reservoir. Even if they had asked this for the first time, it would be unreasonable. We do not even ask for compulsory powers, but simply an extension of the powers given us in 1863, and there is nothing in the bill which alters our position more than giving us time to complete our works.

Mr. *R. Iddon*, examined by Mr. POPE.

I have been secretary and manager to the company for five years. The company was first incorporated in 1841, and the capital was £7500, with power to borrow £3000. Two reservoirs were constructed capable of holding 5 million gallons, and the district of supply was Old and New Accrington. We had a gas-work capable of supplying 30,000 cubic feet per day. The whole of the capital was expended in stock. The second Act was obtained in 1854. Between 1841 and 1854 we constructed the Burnley Road reservoir, and we increased our capacity for serving gas. The cost of the works was £11,814, which sum the company borrowed. The Act of 1854 repealed the Act of 1841, and extended our district of supply; that included the townships in the plan. By that bill our capital was increased £70,000, and we were authorized to pay 10 per cent. on the old capital and 8 per cent. on the new. Our borrowing powers were increased to £15,000; 6s. was fixed as the maximum price for gas. We were authorized by the Act to construct the Mitchell House reservoir. The Act of 1854 incorporated the Act of 1847. In 1863 the company applied for another Act, first of all with the view of extending the district supply, as coloured brown on the map. The Hargreave Dean reservoir was authorized to be constructed by the Act of 1854, and powers were asked to enlarge, and were authorized by the Act of 1863. Seven years was the time asked for. We were then authorized to borrow £160,000, and the dividend was limited to 8 per cent. The site of the Hargreave Dean reservoir was deemed bad, and another site was recommended. The company, as far as the Mitchell House reservoir is concerned, merely wished to extend, and no fresh capital is sought for. In 1851 the population of Old and New Accrington was 10,374; in 1861, 17,698; and it is now 25,000. If for the next ten years the increase should be in the same ratio, the population will number about 70,000. In 1841 our stock was £7500, and the borrowing powers £3000. Altogether we have £227,000 worth of stock and £57,600 borrowing powers, making a total of capital and loans authorized of £284,600. We have raised £147,056, which leaves £137,544 of unexercised money powers, so that there is really a margin of £140,000 left to make good any mischief the company may do.

Cross-examined by Mr. WEBSTER: We have supplied water to the amount in money of £3273 9s., during the past year, to the district, but I do not know how many gallons. We have four reservoirs—three Burnleys and one Cliff. The capacity of the two small Burnleys is 5 million gallons; the large Burnley, 18½ millions; and the Cliff, 5 millions. In 1854 we had only three reservoirs in use. Mr. Bateman obtained the Act first. I believe he supplied the plans for the Mitchell House reservoir, and it was begun in 1857 and completed in 1868. Mr. Jas. Taylor was contractor, but he did not finish the work. Mr. Bateman continued as engineer from 1858 to 1861, when he ceased to be engineer-in-chief. I do not know that he said it never would hold water; I have seen water in it within 3 feet of the top, and have seen it there for three weeks at a time. The water was let go; but it did not go of itself. I believe every attempt to make it water tight has failed.

The CHAIRMAN: You admit that, I think, Mr. Pope?

Mr. POPE: Oh, certainly. The object of the application is to have a better one, and one that will be water tight.

Cross-examination resumed: The original contract was £15,000, but there were a great many extras. I cannot say how much has been expended on the Mitchell House reservoir, but should think £40,000. I think Mr. Foster was the engineer after Mr. Bateman. The number of houses we supply with water amounts to 4810 for the whole area.

Re-examined by Mr. POPE: All the trades are gathering round the district, and are largely engaged in the cotton trade.

Mr. *T. B. Foster*, examined by Mr. POPE.

I am a civil engineer. With regard to the Hargreave Dean reservoir, we propose to construct that instead of the one authorized by the Act of 1863. The owner is a consenting party to the bill. In ten years the population will, in all probability, be increased to 70,000. Before 1863 the population increased so rapidly that the bill was sought for, and I am not likely to change my opinion in 1869. With the exception of a small piece of land, we do not purpose to interfere with more than what is given by the Act of 1863. In 1857 Mr. Bateman left Manchester, and by arrangement I carried out the completion of what he began, and which was effected, I think, in 1869. The reservoir commenced by Mr. Bateman never was water tight, and, when he ceased to be their engineer, I was asked to take his place, but declined, and the company took the matter in their own hands. It is not water tight now. It was full recently to within a short distance of the top, but it broke through. It was not the fault of the strata, but through the original contractor. The intended enlargement will not touch the present reservoir at all. There is a solid embankment running along the spur of the hill, and that will form the inside part of the embankment, and therefore we do not anticipate any leakage.

Cross-examined by Mr. WEBSTER: The reservoir was not water tight when Mr. Bateman left. I saw the reservoir once a year to see how it was going on, but not as engineer of the company, but for my own interest. I never saw it anything like full. It is small, that is the reason we wish to enlarge it. At the lowest point there is broken rock. At the level of the brook there is tight rock, and that goes to the middle of the hill. I do not know how far Messrs. Hargreaves have advanced their works towards the Mitchell House reservoir. The strata of the soil of the proposed reservoir is the same as the other. I feel confident that the new reservoir will not leak at all. The proposed addition is five acres. The whole of the ground within the limits of deviation is one acre and a half. The rock we finished in is not open grit, but rock and shale. I have not made myself acquainted with the thickness of the coal under the Mitchell House reservoir. I do not know anything of the workings on the south-west side. I have never suggested to the company the abandonment of the reservoir. The difference between the contract price and the money paid to Mr. Taylor was something considerable. Mr. Bateman made the Greenfold reservoir, and in some respects it is on a soil or ground something like what the top part of the Mitchell House reservoir is, and it is not water-tight. It was made for Messrs. Butterworth's print-works. £8000 was the contract price, but a great deal more was expended on it. I made another reservoir for Messrs. Butterworth. The Greenfold reservoir would be, as the crow flies, a little under three miles from the Mitchell House reservoir. I cannot tell how much water has been supplied, as I have nothing to do with that. The Burnley Road reservoir capacity is 23½ million. Including this the watershed is not more than 142 acres. I do not know what is taken from that. The Cliff reservoir is 5 million gallons. It is 500 feet above the sea. The Burnley reservoir is about 140 feet. Accrington is supplied from the Burnley Road. The level of Harwood Dean reservoir is about 160 feet, and its capacity is something over 200 million gallons. Its watershed is 500 acres, and the Cliff has none, and gets its water from Harwood Dean, and we have water supplied from there to Accrington. There are many places lying between which will also be supplied, and are very populous. The area covered will be 12,000 acres. Accrington, during the drought last year, was supplied from the collieries.

Re-examined by Mr. POPE: I do not apprehend any danger from these workings, or in such a case as this I never heard of any leakage into a coal mine. I never had the smallest notion of abandonment of Mitchell House. It is all but water-tight, and I believe the next attempt will make it so.

Mitchell House is higher than Harwood Dean. The latter will supply the lower portion of the district, but we must get water from a higher level to supply the whole district. We have proved the nature of the rock at the bottom of the reservoir by our works. I do not apprehend any danger whatever. The Tap Hall Colliery is on the Walden Brook.

Dr. PLAYFAIR: What was the cause of the first reservoir not holding water?

Witness: The puddle trench was not large enough.

Mr. *Henry Eaton*, examined by Mr. POPE.

I am a mining and civil engineer, residing at Ratcliffe, near Manchester. I have contracted to make reservoirs for the Bolton Corporation and the Rochdale Canal Company, and have been also engaged as engineer on the Lancashire and Yorkshire Railway, and have had to deal with works of this character. I was also an engineer on the London and North-Western Railway. I agree with what Mr. Foster has said. I do not apprehend any danger from the leakage of the Mitchell House reservoir. I have never heard of Messrs. Hargreaves getting any coal from under the reservoir, and I do not knew whether or not there is coal there. I never heard of leakage into a coal mine through strata. If Messrs. Hargreaves have minerals beneath the reservoir, there is nothing in their case which is not provided for in the general legislation of the country.

Cross-examined by Mr. WEBSTER: I know nothing of Messrs. Hargreave's workings. I am not quite sure but that the Lancashire and Yorkshire Railway went over a portion of the ground, and, if so, I may have been there to give the company notice. The puddle wall is on the west corner of the Mitchell reservoir. From the top of the embankment to the puddle trench would be 75 to 80 feet. The depth of the embankment would be about 75 feet. Certainly I have heard of water getting into mines, but only by a shaft. As an experienced person, I can say that if the mine is worked, there will be no danger, as it is but a 24-inch mine. I have seen the hole in the puddle wall, and I do not think there will be another hole. I know that I made a reservoir near Bolton over very similar strata. I never examined the Greenfold strata, and do not know anything about it. I did not pay much attention to what Mr. Foster said about it. It is a matter depending on the coal measures, and I believe that to be decidedly water tight.

Re-examined by Mr. POPE: If Messrs. Hargreaves had driven up to "a fault," there would be no danger of the working being affected.

TUESDAY, MAY 4.

The CHAIRMAN said he did not wish to interfere with Mr. Webster's cross-examination, but it had occurred to the committee that on some points his evidence was rather diffuse—as with respect to the wants of the neighbourhood in regard to water supply—and did not bear directly on the question at issue.

Mr. WEBSTER: We say that the Mitchell House reservoir is unnecessary, that the district can be supplied from other sources, and that therefore the bill is unnecessary.

The CHAIRMAN: I think the owners and lessees of the collieries are entitled to absolute security for their works, but I do not see that they have a *locus standi* to object to the proposed works on the ground that they are not necessary.

Mr. WEBSTER: The promoters want to get an extension of time and an additional quantity of land, which may amount to 30 acres, and that would interfere with the colliery works.

Mr. *John Bird*, examined by Mr. POPE.

I am inspector of water-works in the Accrington district. Some bore-holes were made four or five years ago near the reservoir, about 350 feet below the bottom. That was about half a mile from the reservoir. In the course of last year another hole was sunk near the reservoir—that being sunk about 80 yards—and it brought up a good spring of water within 4 feet of the surface. The depth of 80 yards would be about 200 feet below the bottom of the reservoir. So far as I know that is the nearest approach the Messrs. Hargreaves have made in search of coal, and as yet they appear to be working no coal in the direction of the reservoir. I am acquainted with the nature of the floor of the reservoir. The lower part of it is solid rock. At the sides there is loose grit, and there is a puddle bank; but at the bottom of the reservoir there is a good solid bottom over the whole.

Mr. POPE: This enlargement of the reservoir—sanctioned in 1863, and which you are now asking time to extend—is required for the storeage of the larger quantity of water you are authorized to collect?

Witness: Yes.

Examination continued: There is a by-wash, which I have seen running with water when the reservoir was pretty full. When the water has been running down this by-wash I have observed no diminution of the quantity of water in the reservoir.

Cross-examined by Mr. WEBSTER: Last year the Mitchell House reservoir was full up to within 3 feet 6 inches of the top. There had been floods, and it remained full for months. I do not know how many houses there might be in the district that could not receive supplies from the reservoir. I have seen it remain full for months to the depth of 40 to 50 feet. The puddle bank extends round from the north to the south side of the reservoir, for about half its extent. I am not an engineer, but only an inspector. I do not know precisely the nature of the coal workings in this particular locality, but I understand that there is no coal at what is called the Black Moss bore.

Re-examined by Mr. POPE: With regard to the Black Moss bore, this bore was sunk six or seven years ago, and I learnt from the colliers that in making it there was no coal found the whole depth of 350 feet below the reservoir. The highest level of the water in the reservoir at the time of the floods occurred, I believe, in January this year, but it continued full, more or less, during December and January, up to 40 or 50 feet.

Dr. PLAYFAIR: When there was no extra flood, at what rate did the water subside?

Witness: It escaped through leakage, but very little. The water was drawn off by means of valves.

Mr. WEBSTER: You said the bottom of the reservoir was good solid rock over a part—which part?

Witness: I said that over the whole of the bottom of the reservoir there was good solid rock.

Mr. WEBSTER: Do you mean to say there are no crevices in that rock?

Witness: None in what is called the lower rock.

Mr. POPE (to the committee): That is now our case as to the extension of time.

Mr. WEBSTER then proceeded to state the case for the petitioners. He thought there was some ground for complaint with regard to the way in which the promoters had neglected to bring before the committee witnesses who knew the nature of the coal workings in the locality. No witness who had come forward had thought fit to inquire into the nature of these workings. With regard to the object of the bill, it was said to be only an extension of time, and that no further powers were asked; but he contended that it was a most serious matter for the petitioners. The circumstances of the case were of a peculiar character. This Mitchell House reservoir was sanctioned in 1863, and the state in which the promoters had left the case was hardly satisfactory—the reason, perhaps, why certain witnesses had not been called. Mr. Bateman was the engineer for a long time, but he was not called. Neither the contractor (Mr. Taylor) nor the engineer had been called. Mr. Forster, who was concerned with Mr. Bateman in the plans, was called in; but there was an important period about which there was no information. Where were Mr. Taylor, Mr. Maguire, and numerous others who could have given information to the committee in this case? When it was said that the new reservoir had been sanctioned in 1863 and not opposed by the petitioners as it was now, it must be borne in mind that the circumstances of the case had greatly changed since then. The coal-works were then at a distance from the reservoir, but they had since been advancing nearer to it, and now they were actually within a few yards of the limits of deviation of the reservoir. The Messrs. Hargreaves had been going forward with their works in the belief that the proposed water-works were not to be carried out. Altogether the case was totally different to what it was in 1863. Had the circumstances been the same then as they were now, the Messrs. Hargreaves would not have allowed the bill to proceed without their strongest opposition. One of the grounds on which the petition was resisted was the alleged absence of coal under the reservoir, but on that point, as on others, the evidence which had been brought forward proved nothing. With regard to the character of the rock strata at the bottom of the reservoir, it was evidently not of a nature impervious to water, and the danger to the collieries from perlocation was not to be overlooked. A question arose as to the financial position of the company who were the promoters of this bill; and no witness had stated the terms on which the capital was to be raised, or what security the company were prepared to give in case of damage. The liabilities of the shareholders were limited to the amount of their respective shares, and if the whole of the capital which had to be raised by the company should be taken up, there would be no guarantee for any special damage which might arise from defects in the new water-works. It was to be regretted, in connexion with this financial question, that the chairman of the company had not been brought forward to give evidence, as he should have been able to give some useful information on the subject.

Mr. POPE said he had not anticipated that his learned friend would have raised any such question, otherwise he should have put the chairman of the company in the witness-box.

Mr. WEBSTER said it was the duty of the company, in bringing forward this bill, to have shown to the committee that they had the means of providing for liabilities which, under the Water-Works Act, they knew quite well they would be required to provide for. The petition showed that the proposed water-works encroached on a portion of the petitioners property, that they would thereby be deprived of the free use of that property, and, moreover, that the existence of such a reservoir in that particular locality, in the immediate vicinity of coal-mines, involved great danger to life. On the other hand, no evidence had been adduced to show that additional reservoir room was wanted. He, therefore, appealed to the committee not to sanction a proposal that was fraught with such danger to life, and which was not warranted by the wants of the place. The committee ought to treat this case as if the promoters now came before them for the first time asking for the powers set forth in the bill. He hoped the committee would decide in favour of the petitioners.

Mr. WEBSTER then called witnesses in support of his case.

Mr. *Hudson*, examined by Mr. WEBSTER.

I am one of the managers of the petitioners collieries in the Accrington district. I remember when the Mitchell House reservoir was begun. Mr. Taylor was contractor. I do not recollect at what date water was first put into that reservoir. With regard to the puddle bank, it has been open from time to time within my knowledge. I have never seen the reservoir quite full except once, about the end of last year. We had floods in the neighbourhood at that time. I could not say how long the reservoir remained full. I have seen the bottom of this reservoir, and I know the nature of the rock—it is what is geologically termed "tumbling cob rock," and is by no means impervious to water. We have about 55 colliers at present at work in that locality. They are now working coal approaching to within 20 yards of the limits of deviation of the reservoir. We get surface water into the mines. While down in the mines, I could tell a rainy day, if it had rained for some time, so that the water might have time to percolate from the surface. In the direction of the reservoir we are working about 160 yards a head per year. Where we are the roof is shale and rock. Our practice is to take out the coal and leave pillars to support the roof. It is a good roof. We made several bores with satisfactory results. There is a bore near Mitchell House reservoir where there is coal about 120 yards deep. We always expect coal under the tumbling cob rock. Where we are, it is about 60 to 80 yards from the surface. There is a "fault" there which has thrown the coal down about 20 yards. There is no doubt whatever about there being coal in the whole neighbourhood of the reservoir. I have examined the puddling, and I can state positively that the bottom of the reservoir is not water-tight.

Mr. POPE: You have no plans of the workings?

Witness: We have no working plans.

Mr. POPE: How, then, can you tell where you are? Or are you working the colliery at all in the neighbourhood of the reservoir? That may account for your having no plans.

Witness: We are working the colliery, and we had the use of plans; but they have for some time been in the hands of the owner's (the Duke of Buccleuch's) agents.

Mr. POPE: You say you could tell a wet day in the pit?

Witness: Yes; if it had rained for some time.

Mr. POPE: You have never heard of the Mitchell House reservoir doing any damage?

Witness: No.

Mr. POPE: When did you enter the service of Messrs. Hargreaves?

Witness: In September last. I was manager at Burnley for several years before that.

Mr. WEBSTER: What would be the effect of any inundation at the Mitchell colliery?

Witness: It would endanger the colliery, as well as other collieries of Messrs. Hargreaves in the neighbourhood.

By Dr. PLAYFAIR: The coal here is about 63 yards under the bottom of the reservoir.

By Mr. BONHAM-CARTER: We have been about six weeks without the working plans.

Mr. POPE: But you are bound to have plans for the use of the Government inspector?

Witness: Yes.

J. Newton, Esq., examined by Mr. WEBSTER.

I am a civil engineer. I have inspected this Mitchell House reservoir, and made myself acquainted with the strata. Below the reservoir there are

some quarries, from which the character of the strata can be ascertained. The bottom of the reservoir is loose shale. [Some photographs of the interior of the reservoir were produced in support of this statement.] The bottom of the reservoir is not water-tight, and any leakage would probably find its way to the coal workings. The rock at the bottom of the reservoir is full of fissures, which would admit water so as to flood the mines, which would thereby be damaged and seriously endangered.

Dr. PLAYFAIR: By flooding the mines, do you mean by leakage, or by serious inundation?

Witness: By leakage, which might produce a serious inundation.

Mr. *R. Cunliffe*, examined by Mr. WEBSTER.

I am a colliery bankeman, and have had considerable experience in connexion with the construction of reservoirs in the neighbourhood of the locality in question, and have been consulted about the formation of the Accrington reservoir. I have caused some trial holes to be made, and found one portion of the bed to consist of a mass of loose stones. I scarcely think that reservoir is capable of being made water-tight, as the action of the water will waste the puddle, and leakage will take place. I do not think it could be made water-tight, even if the puddle were carried down to the rock at the bottom. The water would, no doubt, to a certain extent, find its way into the coal workings of Messrs. Hargreaves. The tumbling cob rock varies considerably in itself. It is liable to break up into large blocks, leaving fissures by which the water would find its way into the mines.

Mr. POPE: In all your experience of reservoirs, can you tell the committee of any one case in which there has been a serious inundation of mines from a reservoir of any kind?

Witness: Not in my own locality.

In answer to a further question, witness said that at Oswaldthwistle there was a stratum of rock shale, and when you got through that the rock was as tight as a bottle.

Mr. *Henry Bolton*, civil engineer, and chief manager of the collieries of Messrs. Hargreaves, in answer to Mr. WEBSTER, said the petitioners would have been glad to show the working plans which had been referred to, as they would have served the petitioners purpose very much, but they had failed to get them from the owner's agents. Mr. Forster had been mistaken in describing the course of the water-runs in the locality in relation to the colliery workings. With regard to the Mitchell reservoir, there was no doubt that any overflowing or leakage of the water from that reservoir would find its way into those colliery works, and it might possibly inundate the whole of them in the neighbourhood. There was no guarantee for compensation from the promoters of the bill in the event of the collieries sustaining damage from the reservoir.

Mr. WEBSTER: And besides, in the case of loss of life, the damage might be such as money would not compensate.

Witness: It is hard to say.

Examination continued: When the coal is taken from below the superincumbent strata, it is not unusual for the strata to break up, and that, in my opinion, would be the case in connexion with this reservoir. We are now close upon this reservoir, and are in want of the coal, and we very much prefer having the coal itself to getting compensation for it. I do not know the water company's means of giving compensation. At any rate, the shareholders of the company cannot be made liable for more than the amount of their respective shares. With respect to the reservoir in question, the rock at the bottom of it is not flag rock, but what is geologically known as "cob rock."

Mr. WEBSTER: With regard to the bill, are not the circumstances under which it is brought forward entirely different from what they were in 1863?

Witness: Yes; and, besides, at that time our lease was expiring. It was to expire in 1867, and we should not have felt justified then in going to the expense of opposing the bill, as, failing a renewal of the lease, we should not have derived any advantage.

Mr. WEBSTER: Do you not think the old reservoir sufficient for the wants of Accrington?

Witness: I agree with Mr. Newton, who has gone into the question statistically, that the supply is as good as usual in such places. The proportion of the population that would require the higher level that is proposed would be comparatively small.

Examination continued: There is no doubt at all about there being coal in the whole of the district, and under the Mitchell reservoir. Looking at the nature of the reservoir bottom, I should have very little hope of the water being retained by puddling. We are at present working only one mine in that locality, but we have others which we work at times, and compensation would have to be paid in respect of the whole of them.

Mr. WEBSTER: And for the goodwill of the business?

Witness: There is no doubt that if we had to shift our workings our custom would be affected.

Cross-examined by Mr. POPE: We renewed our lease in 1867. The Mitchell House colliery had then been constructed. We were then about two years "get" farther off than we are at present, and we always expected to get the coal or pay for it. The introduction of the bill will alter our position in this respect, that we shall not be able to get our coal under the new reservoir. We did not know that this extension was authorized when our lease was renewed in 1867. If we go under the reservoir we run great risk of inundation. Our works might be "drowned," and there would be loss of life.

Mr. POPE: Now, you do not mean to say that you expect any such inundation as that from the reservoir? At present you pump away the water from your mines, do you not?

Witness: Yes.

Mr. POPE: Do you mean, by an inundation, the water that would filter through crevices in the rock?

Witness: What I mean by an inundation is a larger quantity of water than the pits could be kept clear of. If there was leakage, the fissures, under the heavy pressure of water, would get enlarged, and the leakage would flow more rapidly; although, of course, not so as to inundate the pits in the same way as in the case of an embankment giving way.

This concluded the evidence for the petitioners, and

Mr. POPE proceeded with his reply. There had been a great deal said upon points which appeared to him to be irrelevant to the question at issue. The petition said nothing about many of the questions with which the committee had been so long occupied. The only point in the petition that had any semblance of truth was where it was alleged that by the construction of the works there might be some danger to the neighbouring coal workings, from the possibility of the water from the reservoir bursting into them; but in 1867 the petitioners were aware of that danger, and were then contented to rely for protection on those provisions which the general legislation afforded them. The only question in which the Messrs. Hargreaves were interested was as to what provision had been made by general legislation with respect to any danger which threatened them in connexion with these water-works. It had been asked—were the company in a position to make good any damage that might arise from their works? The company were backed up by an unissued capital of £135,000, and there was no claim likely to arise which they would not be able to satisfy. As for any leakage there might be, if there were any it would be so much the worse for the company, who would lose by waste of their water supply, and therefore they would have even a financial interest in preventing any such waste. But, apart from this, the petitioners had, in the financial position of the company on the one hand, and in the provisions of the general legislation on the other hand, ample security in respect of any possible damage they might sustain. Therefore, the financial position of the company being a sufficient guarantee on the one hand, and the provisions of legislation a sufficient protection on the other hand, there was an end to the case of the petitioners. He could not help thinking that what the petitioners had in view was that, by putting on the screw of parliamentary opposition, they would find a better and more immediate market for the coal than they could do otherwise.

Mr. WEBSTER repudiated, on the part of the petitioners, any such motive.

Mr. POPE concluded with a brief recapitulation of his arguments, and an appeal to the committee in favour of the bill.

The committee retired for a few minutes, and, on their return,

The CHAIRMAN said: The committee are of opinion that the preamble of this bill, as it stands, is proved.

Mr. WEBSTER proposed to introduce into the bill a clause to the effect that, whereas doubts were entertained as to the possibility of making water-tight the existing reservoir, and as it was believed that the coal workings could not be carried on underneath the reservoir without endangering the lives of the colliers, therefore the water company should not be allowed to collect water therein until provision should be made for making it perfectly secure, and until a sum of money should be deposited as a guarantee that the company would be in a position to make good any damage that might arise from their works.

Mr. POPE ridiculed the proposal of his learned friend, as being an ingenious device to reverse the decision of the committtee. The proposal was most absurd, and he could not suppose that the committee could for a moment think of entertaining it.

The CHAIRMAN intimated that the committee could not agree to the insertion of the proposed clause.

Legal Intelligence.

DUNDEE GAS ARBITRATION.

(*Before* HENRY HAWKINS, *Esq., Q.C., and* THOMAS HAWKSLEY, *Esq., C.E., Arbitrators; and* G. POWNALL, *Esq., Umpire.*)

(*Continued from page* 528.)

FIFTH DAY—MONDAY, MARCH 22.

Mr. DAVISON said he wished to mention that in the rectified balance-sheet would be found an item of £9864 13s. 5d., which was wrong to the extent of £124 12s. 5d. That figure had been given to Mr. Guild as the income-tax for that year; but, in point of fact, it had been paid after May. Making that deduction, the figure was reduced to £9740 1s.

Mr. *Jamieson* recalled, and examined Mr. PHILBRICK.

The bad debts were dealt with differently in 1867 from what they were in any previous year. The same course was followed in 1868, but the effect was not so considerable, because the change was not so abrupt, as between 1867 and the previous year.

In reply to Mr. Hawksley, Mr. PHILBRICK said that in the preceding years they had made a certain allowance for bad debts, but the bad debts had not come to that allowance, and therefore the shareholders of that particular year had divided less than they should have done. But when they came to 1867, and were going to sell, instead of crediting to back years the amount they had overdrawn from back years, they put all the accumulated sum to the credit of 1867.

Mr. HAWKSLEY said that was not according to their explanation, but he did not say their explanation was right.

Mr. DAVISON said that was not the fact.

Mr. HAWKSLEY said all he wanted to know was, what was the true income.

Witness: The company lost by bad debts in the year ending May, 1867, £217 1s. 5d. They had carried forward £265 18s. 11d. from 1866 to meet these bad debts, and had thus provided more than was sufficient to meet the bad debts of 1867. They had hitherto throughout their whole career provided in the preceding year something for the bad debts of the following year, but in 1867 they closed their books without making any provision for the bad debts of 1868; so that, on the eve of the arrangement, they altered to the extent of £265 the statement which would have appeared if they had continued on the previous system.

Examination resumed: In 1867 and 1868 there is no allowance for depreciation in the rectified account. For some years a charge for depreciation appears in the statement of revenue account. I have prepared a statement showing the depreciation given by the company. From 1849 to 1859 it was invariably 2 per cent.; from 1860 to 1866 it was 3 per cent.; in 1866 it was 1 per cent.; and since that year it has been omitted altogether. The sum for depreciation was charged upon the balances which year by year appeared at the debit of their works.

A comparative statement as to the allowance for depreciation of meters was here handed in, showing, first, the total cost of meters and the meter-rents, &c., credited to meter account; and, secondly, the balance which would stand against meters if no rents had been credited, but in lieu thereof 7½ per cent. written off annually for depreciation. According to the first view the balance at debit of meter account in the company's books at May 31, 1868, was £6505 2s. 5d., and according to the second view, £10,418 5s. 9d., showing an excess in the latter case of £3913 3s. 4d.

Examination continued: On the 1st of December, 1866, the price of gas was raised 6d., making it 5s. 2d.; and on the 11th of November, 1867, 2d. more, making it 5s. 4d., at which it now stands.

By Mr. HAWKSLEY: That rise was only on the private lights. There was a contract for the public lights, which ran through that period.

Examination resumed: In 1868 there was a decrease in the cost of coal as contrasted with the preceding year, which went to enhance the difference of profits.

Mr. HAWKSLEY: In estimating the profits of the year, has it been the custom to take stock of coal?

Mr. DAVISON: Yes. We can show exactly what there was in stock.

Examination resumed: I ascertained from the books of the company that the stock prior to 1868 had been loosely taken, and not accurately gone into, but in 1868 it was accurately taken. Until 1866 meter-rents had been uniformly charged against the capital account of meters. At the end of that year the meters, with repairs, stood at £5486 14s. 11d. In the

table I have made out showing what would have been the effect of writing off annually a fair amount of depreciation instead of charging the whole against the account, I have allowed 7½ per cent. for the depreciation. Rectifying the meter account in that way, the value in hand would have been £10,418 5s. 9d. in 1868, instead of £6505 2s. 5d.

Mr. PHILBRICK: At that rate you give them the credit of £4000 more than they stand at in their own books?

Witness: Yes. If, instead of taking the arbitrary method of carrying what happened to be the balance of their meter-rents to the credit of their meter account, they had gone on the regular system of writing off an amount of depreciation at 7½ per cent., that would have been the result. I have allowed a return of 6 per cent. and a 20 years life for the meters. I do not pretend to any special knowledge about meters, but I did it in my own way. The effect of the course the company have pursued of bringing the meter-rents and repairs into the accounts, and not making any allowance for depreciation, has been to enhance their revenue to the extent of £793 in 1867, and £1076, I think, in 1868. From my examination I find the company have largely exceeded their borrowing powers. In 1867 there was due on bond £24,900, and on floating debts £9780 11s., making altogether £34,680 11s., as against £20,000 of borrowing powers, showing an excess of £14,680. Against their floating debt it is only fair to put the debts due to the company, which would be about £7250 if they were all got in.

Mr. HAWKSLEY said he thought it was admitted that the company were to clear their debts.

Mr. DAVISON: We have cleared them every shilling.

Mr. HAWKINS inquired what the evidence now being given was wanted for.

Mr. PHILBRICK said that supposing the company were unable to go on without some increase of capital unsanctioned at that time, which they would have to get sanctioned by Parliament if they were developing their resources, it would be clear that they would have some statutory limit put upon them as to the profits.

Mr. HAWKINS: I can thoroughly understand that if, in order to keep the thing a going concern, it is necessary to borrow £20,000, the interest on that would be a charge against the gross revenue. But do I understand you to put it thus—that they are obliged to borrow in excess of their statutory powers, and that they must ultimately go to Parliament for the purpose of getting statutory powers to borrow the excess they require; and that, going to Parliament, they would have a limit put upon them in some other matters?

Mr. PHILBRICK: Quite so.

Mr. HAWKINS: So that we should have to estimate the probable restraint which the Legislature would put upon them when they went in that way?

Mr. PHILBRICK: I do not know that I should put it quite so boldly as that, but the agreement having been made, the money bill was allowed to pass unopposed. But it has a very material bearing upon the question how far these profits are to be capitalized or deemed to be a certain revenue from a going concern not subject to competition. What was the position of the company in all these matters becomes very relevant, I think.

Mr. HAWKSLEY: They having got their Act of 1867, and you having got your Act of 1868, you ask us to consider the company's position with respect to what might have been their status if they had been allowed to go beyond November, 1868.

Mr. PHILBRICK: We say that the proceedings in 1867 and 1868 were the result of an agreement between the parties, whereas if we had each of us gone to maintain our own before the House the result would have been very different, because this is quite exceptional to any gas legislation.

Examination resumed: With regard to the consumption of gas, the rate of progression of gas sold in 1865 over 1864 was 9,700,000 cubic feet; 1866 over 1865, 9,247,000; 1867 over 1866, 6,011,000; and 1868 over 1867, 94,000 cubic feet. During the first three years mentioned the trade of Dundee rose with great rapidity, and the extent of it was a matter of notoriety over the whole country.

By Mr. HAWKINS: That state of things is not continuing now.

By Mr. PHILBRICK: That prosperity was due to the cotton famine in the first place, which gave an increase to the linen trade at the expense of the cotton trade. In those years the profit which arose from the increase of consumption of gas was largely met by an increase in the cost of coal. In 1865 the net profit per 1000 feet of gas sold was 1s. 9·16d. The price of coal per 1000 feet then was 2s. 5·09d. [Witness handed in a table showing the income and expenditure per ton of coal carbonized and per 1000 feet of gas sold for the four years ending May 31, 1868.] In 1866 the price of coal was 2s. 6·87d., and the profit then fell to 1s. 0·9d. In 1867 the price of coal came up to 3s. 1·23d., and the profit was 1s. 0·97d. In 1868 the price of coal fell to 2s. 9·87d., but the profit, notwithstanding a large increase in the price of gas, still stood at 1s. 9·36d., being, after deducting the meter-rents included in 1868, but not in 1865, 2·25d. lower than in 1865. I have put the coal carbonized and the coal used as fuel together. The profits made by the operations of the company in those years were respectively, beginning with the year ending May 31, 1865, £7926, £5325, £5677, and £9365, showing the fluctuations. These results are, of course, exclusive of any allowance for depreciation, and also excluding bad debts, except such as had been actually ascertained.

By Mr. HAWKSLEY: This is the actual result shown by the books of the working of the company for these years, without any rectification whatever.

Mr. HAWKSLEY: You say "exclusive of allowance for depreciation," but I suppose it includes any expenditure upon renewals which the company in those years might have found it necessary to make?

Witness: The company were laying out money during those years largely on their works, amounting to £15,000 or £16,000, which were charged to capital. None of that expenditure was made out of profits; it was provided entirely from the capital resources of the company, by borrowing money in the first place, and paying it back afterwards. The books of the company are kept with great clearness on that point. They charged against revenue what was chargeable against the revenue, and at the same time they were charging against capital the capital expenditure.

By Mr. PHILBRICK: In the books of the company current repairs are distinguished from renewals and retorts in the charge against revenue. The income available for dividend during the period mentioned fluctuated even more than the gross results. In 1863 it was £3192; £4783 in 1864; £4908 in 1865; £3524 in 1866; and in 1867, after taking off the meter-rents, in order to make the contrast perfect, £3124. During those years the population had increased from about 98,000 to what is estimated now to be 110,000 or 115,000. Contrasting 1865 with 1868, by the 1000 feet of gas sold, the following are the results:—There was an increase in 1868 over 1865 in the gas revenue of 5·47d.; the secondary products in 1865 exceeded those of 1868 by 5·86d. The meter-rents in 1868 exceeded those of 1865 by 2·45d. The difference in revenue, therefore, of 1868 over 1865 was 2·06d. Then, coming to the expenditure, the coals of 1868 cost more than those of 1865 by 4·18d.; the wages in 1865 were more than those of 1868 by 1·46d.; the general expenses in 1868 were 0·34d. more than in 1865. Then, in 1868, the retorts and settings were 0·90d. more than in 1865. There is an excess of profit in 1868 over 1865 of 0·2d., after including the meter-rents; deducting meter-rents, it would be 2¼d. in favour of 1868. The increase in the receipts of 1868 over 1865 is due to an increase of production slightly, and to the rise in the price of gas. The increase of production is accounted for chiefly through an increase in the consumption, but partially also through an increased yield of gas per ton. The unaccounted-for gas was 25·790 in 1868; in 1865, 24·272; in 1866, 22·320; and in 1867, 22·805.

Mr. PHILBRICK: With regard to the result shown by these figures as to the management of 1868 as contrasted with the preceding management—which is said to have been careless—what do you find is the result?

Mr. POWNALL suggested that there seemed to be only two questions at issue—was there any, and if so what, prospective increase of income? and were certain items proper to be deducted, together with the income-tax and the direction? Upon all other questions the parties seemed to be agreed. The vendors said that the sum of £26,529 would be increased very much by the increase of the town of Dundee; and the corporation, on the other hand, said there were items which should be deducted.

Mr. PHILBRICK said, if it was to be taken that they had the facts they knew of, and which Mr. Jamieson would prove, to found their case upon that was sufficient. His learned friend, Mr. Michael, had calculated the, average for those years for Mr. Hawksley.

Mr. MICHAEL: It comes to 1s. 6·98d.; it may be taken as 1s. 7d.

Mr. PHILBRICK (to witness): In 1868 is there any trace, so far as the figures are concerned, of a superiority of management?

Witness: In 1867 and 1868 the production of gas may be taken as identical. The wages, which would show the result of management, are 6·17d. in 1868, and only 5·95d. in 1857. General expenses are 1·32d. in 1868, and 1·15d. in 1867. Then the retorts and settings are lower. Service-pipes in 1865 were 0·75d., and in 1868, 0·24d.

Mr. HAWKSLEY: But you must recollect it was explained to us that in some of the accounts the cost of service-pipes used for new tenants was mixed up with the cost of service-pipes used for repairs?

Witness: I did not know any of the particulars; that was merely from the books.

Mr. HAWKSLEY: But you cannot take the books without explanation; and besides there is another thing to bear in mind, that the service-pipes are included in the 1 per cent. for renewal.

By Mr. HAWKSLEY: The expenditure on coals carbonized per 1000 feet in 1865 was 2s. 5·09d., and in 1868, 2s. 9·87d. The coal used for fuel in 1865 was 0·82, and in 1868, 0·22.

By Mr. PHILBRICK: Comparing the two years 1865 and 1868, there is a difference in the profit made—leaving the depreciation out altogether in 1865—of £1439 in favour of 1868. That has arisen from the charge of meters being at the rate I have already given—£1076—and from the profit on the additional consumption being, on 15 million odd cubic feet, £1358. That is the rate calculated at the rate of profit earned by the company in 1865—the increased production of 1868 valued at the rate of profit of 1865; but then the profit of 1865 was greater than that of 1868, and therefore you must take off the difference in the rate of profit in 1865 over 1868, being at the rate of 2·25d., which makes the difference altogether £989 18s. 5d. That deducted from the two former items leaves £1439. The average divisible profit for the five years ending 1867 is £5481 1s., exclusive of interest. In estimating the value of the concern, the first thing which must be provided by every company is the capital necessary for carrying it on; and therefore from this sum must be deducted the interest on the capital required for the conduct of the business, which I take to be £15,000.

Mr. HAWKSLEY: Tell me why you deduct that. Supposing there is £15,000 required for the conduct of the business, and that £15,000 is raised by shares, as it commonly is, then the profits of course would be distributed over the shares, and would be reckoned not as a deduction, but as a part of the profits.

Witness: The profits so divided would be of course subject to the interest of the money provided. From whatever source the money comes, it must be unproductive to the extent to which it is required for the conduct of the business.

Mr. HAWKINS: Perhaps the simplest way of testing the matter would be to suppose this to be not a company at all, but the trade of gas-making carried on by a private individual, and in order to carry on the business it is necessary he should have £10,000 of money floating, which is unproductive in the shape of interest. Now you want to ascertain what is the profit actually earned from trading, and you say that in order to earn your trade profit you are obliged to lose the interest of the money you had lying idle at your bankers or floating, which if you had chosen to let your money out at interest, irrespective of trade altogether, you would have got. Therefore, inasmuch as you are obliged to sacrifice the interest of your £10,000, you must make that a debit against the gross profit before you get to the net: is that what you mean?

Witness: That is precisely what I mean, and precisely what the commissioners have had to do in this case.

Mr. HAWKSLEY: That is not what I mean. What I mean is this: what is the tradesman's profit before he distributes the money—either appropriates it to himself, or pays any part of it to his banker, or to a mortgagee of his property by way of interest?

Witness: His gross profit will always be on the deduction of the interest. Those gross profits I would assume to be £100, which he has made by his trade that year, in order to enable him to make which he had, either out of his own or some one else's pocket, to add £500. That money, if he had kept it, he might have put out to Consols; but getting it from another person, he had to pay interest. He could not start without that £500, and therefore it was essential he should pay for that money as well as for his cloth, or any other material he required.

Mr. HAWKSLEY: Therefore if money were at 5 per cent. you would say his profit is only £75; but is not the £25 also his profit?

Witness: No; it is the profit of the man who lent him the £500. Supposing he finds the money itself, it is not his profit, but the profit of the money. The income-tax would be calculated upon the £100, because the trade has made that sum for two persons.

Mr. HAWKSLEY: Supposing a company, instead of making any calls whatever, chose to borrow the whole of its capital, and found somebody to lend it, that capital is partly expended in works and partly used in carrying on the undertaking—buying coal and otherwise. Then there came a time when it wanted to sell its undertaking, and the condition upon which it should sell its undertaking is that the person who buys it shall be free of all the debts of the undertaking; supposing the capital to be employed is, say,

£100,000, what sum would the person who wants to purchase have to give for those works?

Witness: Just the amount of the value of the works.

Mr. HAWKSLEY: Then if that be so, what does it signify where the money comes from at all, excepting to the persons who are to be paid.

Witness: It makes no difference whatever to the purchaser.

Mr. HAWKSLEY: If the payer does not take the liability, and there is no interest to pay upon its floating capital, why should it be a deduction from revenue?

Witness: The way in which it presents itself to my mind is this: in the case which you have put, of their raising money and having no debt, the income of the first year of their existence will consist of the revenue derived from their trade, and the interest of the money which they had lying in the bank unapplied.

Mr. HAWKSLEY: I am not going into the working of the company at all; I am going into the state of the company at the end of its existence, and I suppose that the company has raised all its money by shares enough to work it, as well as enough to build its works.

Witness: Then, of course, the purchaser pays the value, and he has no interest and no concern with the distribution of it.

Mr. HAWKSLEY: Supposing that the company raises all its money—everything that it requires—by shares, and has no debt at all of any kind whatever, then what is to be paid to the company? Is there any deduction, in point of fact, for interest upon anything?

Witness: Unquestionably there is; because, although it does not in name and in appearance and in book-keeping transfer so many pounds to its creditors, it does take those pounds out of the pockets of its own shareholders, who, if it did not take them, would have the money in their pockets to get interest on. If the money has been taken out it must be put back in the shape of dividend.

Mr. HAWKINS: I take it that the worth of the undertaking consists, while the trade is carried on, of the works and the business carried on there; and while the works are carried on, the only proceeds that can be derived from the undertaking are the profits of trade. The trade ceasing, the works remain valuable as land and as structures for what they would fetch in the market. Then you come to ascertain your net profits, which are those actually going into the pockets of the trader after every expense is paid. If you have to keep idle £10,000 which you could make interest of yourself, it is very much the same, as regards trade, whether it is your own money or you have to borrow it and pay the interest on it?

Witness: Yes.

Mr. HAWKINS: Supposing you have two partners in trade, and the capital is £10,000, but that capital is found by one partner, the other bringing in nothing, and the gross profits of the trade amount simply to £500 per annum, the partner who brings the £10,000 capital wants the £500 to pay the interest on the money, what is the value of the other partner's interest in the £10,000? *Nil*, is it not?

Witness: Just so.

Mr. PHILBRICK: Is there any other item which ought to be deducted, in your view, from the average of the profits of the preceding year—£5481—in order to arrive at the average net revenue?

Witness: Yes; I find from the Act of Parliament of the new company that by section 58 it is provided and enacted that it should not be lawful for them to accumulate or "to do any other act or thing whereby the beneficial operation of competition in the manufacture and sale of gas may be impeded or obstructed." I find from an agreement—a copy of which has been put into my hand—that in spite of this enactment the companies did come to an agreement for the purpose of staying the beneficial arrangement of competition, and obstructing and impeding the same. That agreement came into effect in 1855-56. The new company came into operation in 1846-47, and there were thus nine years of competition. For the nine years preceding the competition the average annual rental of this company was £3550 10s. 1d.; for the nine years of competition it was £2542 16s. 10d.; and for the nine years following the agreement it was £3624 16s. 11d. Respecting the dividends which they had declared for the nine years preceding the new company, they divided £3194 8s. 10d.; during the nine years of competition they divided £2013 16s. 8d.; and during the nine years after the agreement they got up to £3402 16s. 8d. I have here a return of the selling price of the shares. [Handed in.]

Mr. *G. Thornton* was called to verify the table, which had been made up by him from the register of the transfers and from the transfers themselves.

Mr. POWNALL asked what use was going to be made of the document, and

Mr. HAWKSLEY inquired how the sale price would determine anything more than what the public thought the dividend was worth.

Mr. PHILBRICK said he thought it was a very material fact if it did show what the public thought of the dividends to be declared, because it confirmed the dividends that actually were declared.

Mr. POWNALL said that the state of the money market and the state of trade in Dundee at the time of each sale ought to be known.

Mr. HAWKSLEY said that when a company had for a long time been in the habit of paying low dividends and appropriating part of its profits, and had all at once discontinued that practice and made calls and paid large dividends, the value of the shares had jumped up immediately, so that all those circumstances must be taken into account.

Mr. *Jamieson* recalled, and examined by Mr. PHILBRICK.

The average selling price of the shares for the nine years previous to the new company was £50 15s. 3d.; during the nine years from the commencement of the new company to the date of the agreement, £32 7s. 6d.; and during the nine years subsequent to the agreement, £47 2s. 4d. The average profit on the gas sold for two years previous to the date of the agreement was 1s. 10d.0·882; and for the two years subsequent to the agreement, 2s. 1d.0·75. With regard to the expense of maintenance of works, I observed that there was a considerable reduction in that item, and I have taken the average of the three years preceding 1867—the expenses laid out on the repairs of works, repair of meters and service-pipes in those three years on the average, and I have taken the same expenses for the year 1867-68, and the difference is £693 4s. 1d.

Mr. HAWKSLEY: As regards the repairs of meters, did not that include the expense of placing them under the Sale of Gas Act?

Witness: The £322 14s. 11d. which I put down as the average of the expense of repairs is what appears in the books.

Mr. HAWKSLEY: But we have had it here again and again that a large sum of money was expended in altering the meters to make them conformable with that Act, and that is only a temporary expenditure.

Examination resumed: My average of those three years includes the repairs only, as I have ascertained them by an estimate. The books for 1867-68 show the amount which was laid out on what may be called the restoration of meters, and I have taken the same proportion for the three previous years, in which the books do not give the materials. The 2 per cent. I have allowed for depreciation of meters I have taken on the authority of the company itself. On the question of bad and doubtful debts and expenses of recovery I have again taken the conduct of the company itself as my rule. They had laid aside £500 for many years, which met their actual bad debts, and left a margin over for unascertained bad debts, and I have applied the same principle here.

Mr. HAWKSLEY: With respect to the evidence on the other side, to the effect that somewhere between £300 and £400 was what they found to be the actual amount of the bad debts *de anno in annum*, why do you increase that to £500?

Witness: Because the bad debts which they have ascertained are one thing, but every reasonable man in the conduct of a trade provides for doubtful debts. At the end of 1865 there was outstanding £5998; £5813 in 1866; £7232 in 1867; and £9307 in 1868. The bad debts written off in 1865 were £215 8s.; in 1866, £224 0s. 9d.; in 1867, £242 5s.; and in 1868, £309 18s. 4d.—average about £325. That is for ascertained bad debts.

By Mr. PHILBRICK: In the year in which the company's business increased 25 per cent., the increase in the bad debts was nearly 50 per cent.

By Mr. HAWKSLEY: I do not know whether there are any bad debts of so early a period as 1865 remaining on the books of the company, but I should think it exceedingly unlikely.

By Mr. PHILBRICK: With regard to the question of the capitalization of the surplus revenue of the business, and turning it into perpetual annuities, I have here a surplus revenue yielded by trade of £4993 10s. 9d.; and the first thing that I have to do is to capitalize that profit, which I have done by taking 16¾ years purchase of the revenue, representing a return to the investor of 6 per cent., which I think is a proper and legitimate return for money invested in trade of this character. That would bring a capitalized amount of £83,222 5s. 11d.

Mr. PHILBRICK: With regard to the conversion of that capital sum into annuities which are to be charges, supposing it were necessary to seek funds in the general market, and to go amongst insurance companies or capitalists who would lend the money, what does your experience say on that matter?

Witness: I should have very little doubt that in a normal state of the market, and seeking the capital from large investors, this is a security which would be got at about 4½ per cent.—probably 4 per cent., if raised in Dundee. If a higher rate of conversion than 4 per cent. were to be allowed, the gas proprietors would make a bonus by the transaction. They would immediately sell their annuities at a profit. Taking the £83,222 at 4 per cent., it represents an annuity of £3328 17s. 10d.; at 4¼ it would come to £3536 18s. 11d.; and at 4½ it would be £3745. I think the people in Dundee would be satisfied with a less return for money invested in this security than the general public, and that is a fact proved over and over again by experience, not only in Dundee, but in every town in Scotland, which leads me to the conclusion that local people take as a matter of fact local securities, and that local securities in the district are at a greater premium than if they are put upon the general market. I have ascertained and verified the prices charged for gas in Edinburgh, Glasgow, and Paisley.

Mr. DAVISON objected to the witness giving that evidence.

Cross-examined by Mr. DAVISON: First and second class securities are very conventional terms. A first-class security in England is one thing, and a first-class security in Scotland is another. In Scotland we are in the habit of speaking of first-class securities as securities which are invested on mortgage or heritable security, with a margin over of probably a third after paying interest on the debt. That is a first-class security, and I do not put any security constituted as these are on a par with that. For first-class securities in Scotland we get 4 per cent., and for second-class 4½ per cent. I think 6 per cent. is the fair rate of return which any person investing in such a security as this would expect.

Mr. DAVISON: Do you think there is any difference between an undertaking the business of which is carried on under a statute, and that which is in the hands of a joint-stock company or a private individual?

Witness: I draw a great distinction between an ordinary trading company and one which is secured a monopoly by Act of Parliament, but I do not draw the same distinction between a company which merely has the sanction of Parliament for the operations necessary for the conduct of its business without any guarantee that these same powers will not be conferred on any applicant that comes to ask for them. I mean, to take an instance, that a railway company is a largely protected interest; a gas company is not in the same sense protected, because, as every one knows, the moment a field for competition opens up, it is supplied. A gas company without statutory powers I should think a very unsatisfactory thing. No gas company in a town like Dundee, without statutory powers, could advance a step.

Mr. DAVISON: Having valued a statutable company at 16¾ years purchase, what do you value a company at without an Act of Parliament?

Witness: I should require to see how it would get on. I will give you this answer at once—you must depreciate very considerably the value. The fact of competition existing in a town must alter the value of it. I have arrived at the 16¾ years purchase upon the basis that money invested in a trade such as gas-making ought to be expected to return 6 per cent.

Mr. DAVISON: Then is it immaterial in your view whether one company has a monopoly of the whole town of Dundee, or there is another side by side competing with it?

Witness: It is not by any means immaterial, because competition, either immediate or possible, is just one of the contingencies which reduces the value of money put into such a business from 4 per cent. to 6 per cent.

Mr. HAWKSLEY: There are two companies in Glasgow, two in Edinburgh, two in Brighton, two in Leeds. Do you happen to know the results there—whether they confirm your theory or not?

Witness: With regard to the gas companies of Glasgow I do not know; but I should be prepared to believe that the gas companies there show a rate at present below 6 per cent. of return. I cannot give you the facts.

Cross-examination resumed: If I had my own capital, I should expect 4 per cent. if I put it upon a heritable bond; and if I were induced to invest it in gas I should expect 6 per cent. I have valued this undertaking subject to the contingencies which affect every trade—gas-making along with others. I do not put the slightest weight upon this company having the power of dividing an unlimited amount of profits.

Mr. HAWKSLEY: Suppose a gas company, having a dividend limited by Act of Parliament to 5½ per cent., is required by Act of Parliament to sell its shares by public auction to raise new capital, and suppose the public give £62 for every £50 share, how do you reconcile that with what you have stated?

Witness: I quite understand the case, and it appears to me quite reconcileable with what I have said. The limit of the profit in this case is itself a very ample guarantee indeed for the security of the 5½ per cent. If they are limited to the 5½ per cent., that must necessarily suppose there is a

strong probability of the normal state of the business enabling them to exceed that. The public will therefore look upon it very much as a secured annuity of 5½ per cent.

Cross-examination resumed: With regard to the valuation, instead of taking 1868 I should have preferred taking an average of years in a case of this kind. The number of years would depend entirely upon the circumstances which make it necessary to have the average. The average I took was five years, which I thought was right at the time, or I should not have done it. There are circumstances which will disturb every period of average, and there are very grave circumstances of disturbance in the average immediately preceding 1868, and therefore I say that you must take a period sufficiently large to include all those disturbing influences, and how far back you have to go in the history of Dundee to do that I really do not know, because the history of Dundee of late years has been almost entirely abnormal. I know that in the last five years there has been a much larger expenditure than on an average of 20 years on capital on the extension of the business and the works, and also that the price of gas, in three out of those five years, was much lower than it had been over a period of 10 or 12 years, and that the price of coal also was higher than it would have been if taken over 10 years. The element of the rise in the price of gas is not against you, because you must take the price of coal at the same time.

By Mr Davison: Respecting the amount carried from profits which were divisible to capital account, I do not adopt Mr. Guild's figures—£59,000—at all.

By Mr. Hawksley: Unquestionably the company spent £144,000 upon their works, and the question is how much of that amount remains. They wiped off in the course of their existence the difference between that and the present state of their capital account.

Mr. Hawksley: They may have wiped it off upon paper in their books; did they pull down as much as is represented by what they wrote off in their books?

Witness: Of course they did not require to pull down in order that the substance of their works should disappear, and their pipes become worn out, and all the other sources of depreciation come into operation.

Mr. Hawksley: This company has been some 30 or 40 years in existence, and during that time they wrote off from the £144,000 a very large sum?

Witness: Yes; the depreciation was £31,140 16s. 7d. from works and pipes, besides meter-rents—about £60,000 altogether.

Mr. Hawksley: If they were to continue the same system in operation for another thirty years—presumably they would write off more than that sum, because it is a larger undertaking now than it was at the commencement, but suppose the same sum—then they would have written off nearly the whole of the £144,000?

Witness: Yes.

Mr. Hawksley: Then presumably their works would have been worth nothing to transfer?

Witness: The pipes and works, if nothing had been laid out upon them. It is unquestionable that, if you add £60,000 to the other £60,000, you leave very little over of the £144,000

Mr. Hawksley: But if they had expended that additional sum on the works, as they had been doing in time past, their capital, instead of being diminished and next to nothing, would have been increased?

Witness: If they had spent more capital upon them—if they had laid out their revenue in extending their works, instead of dividing it.

Mr. Hawksley: Supposing the works were not increased in magnitude, in 40 years there would be only £24,000 left available. But during that period they would have been laying out upon their works, would they not, this very sum they would have been writing off?

Witness: The other £60,000? Yes.

Mr. Hawksley: Therefore their works, inasmuch as they presumably keep them in repair, besides, out of revenue would then have had laid out upon £144,000, *plus* £60,000, which would have been £204,000; but the value of them would be only £24,000?

Witness: Yes; because I apprehend that the £144,000, so far as it consists of perishable material, will not subsist to very much effect 40 years hence.

Mr. Davison: Is the dividend declared by directors, in your view, a hard and fast line upon which works are to be valued?

Witness: No, I do not think it is; but I should be sorry to think that, during all this time, these dividends did not represent the real honest conduct of the affairs of the company. We have had one case in Scotland of that, and I am satisfied there is no ground for such a supposition here. The case I refer to was the Carron case, in which about £500,000, if I recollect right, was kept back by the managers of the company from the knowledge of the shareholders. I do not remember how much money was recovered, but it was a great deal less than we claimed. This company has not acted in that manner. The £144,992 represents their total expenditure upon capital from all sources. They had to put in some capital. It includes the £29,000 in the borrowing powers. They wrote off with remarkable regularity.

Mr. Hawksley: What the witness means is that an irregularity regularly committed is justified.

Cross-examination resumed: They go on regularly to write off 1 per cent., and 1½ per cent., and 2 per cent. as depreciated. The writing off in the books of the company is most regular and most precise in every year of its existence, with one exception, in 1830, down to 1867. The sum is stated, and the method in which it is arrived at is stated, and the purpose for which it is written off is stated. Nothing could be more precise or definite. If the charge for depreciation is properly made, I will admit that meter-rent ought to go to revenue. I have no doubt there are 17,000 meters in Dundee. Nothing was ever divided amongst the shareholders until the year 1867 out of the meter-rents. The whole was carried to the repairs and the capital account. I have allowed 7½ per cent. annually for depreciation on the figures as they stood in the books, and, taking that view, arrive at £10,418.

Mr. Davison: We have written off whatever they cost us—they have never cost us a farthing—and they stand in our books at £6506, and you take it in another way, which you believe to be fair, and you arrive at £10,418. Therefore there ought to be £3913 added to the £6506, as representing the capital of the meters, and 7½ per cent. is something barely over 13 years purchase, is it not?

Witness: I have made a calculation to get back my money, with 6 per cent. interest, in 20 years, supposing that materials are worth something at the end of the time.

By Mr. Hawksley: Suppose you invest £100 in meters, and credit yourself with interest, and charge yourself with 7½ per cent. depreciation, and at the end of 20 years sell your worn-out materials for £15, you will just recoup yourself.

Mr. Hawksley: Do you think, or do you not think, that the whole plant and apparatus and property of a company hang together for a purpose of this kind, and must all be treated on one general principle?

Witness: I do not pretend to have the least special knowledge on the subject, but I have been informed, and believe, that the life of a meter is a very precarious one, and therefore, if you were to mass the whole of the property of the company in one, in order to estimate the value of the whole, you must look at the value of the several parts; and if the meter is of less endurance than something else, you cannot value it as of the same endurance. £35,000 for meters is a large expenditure out of £144,000. Supposing meters had become more costly in their manufacture, instead of declining, and the company had revalued them, and put them at a much higher cost than the amount of money they had expended upon them, that would not alter the amount of revenue the meters were earning.

Mr. Hawksley: Would you think the commissioners ought to pay more, still having the same revenue?

Witness: I fancy the commissioners will pay for what they get and for the revenue besides.

Cross-examination resumed: As regards bad debts, I think that not only a sum should be written off for the bad debts of the year, but that the company should also write off a sum for the debts which might turn out to be bad out of the revenue of the year. I do not think an average should be taken, because if you sustain losses by debts upon a revenue of £16,000 or £17,000 to a certain amount, you will have sustained losses to a greater amount in proportion to the income from a revenue of £26,000 or £27,000. Moreover, if you sustain losses in bad debts during a period of exceptional exaltation of revenue, when business is exceedingly prosperous, I do not think it is fair to make no provision for the period of depression which from these accounts is creeping upon the community. The company have taken £500, for many years, as the sum to be allowed for bad and doubtful debts, but they have allowed nothing for doubtful debts at the 31st of May, 1868, having written off only the actual bad debts ascertained in that year—viz., £309 18s. 4d., leaving a difference of £190 1s. 8d.; which amount, if they had kept their books as they had done up to 1868, would have appeared to the good in 1869.

By Mr. Hawksley: I conceive that a company closing its books with £9307 due to it will not make more than necessary provision by laying aside £190.

By Mr. Davison: I consider both styles of book-keeping to have been wrong. The proper way would have been to have written off directly the ascertained bad debts, and to have made due provision for the bad debts of the following year which they anticipated, that provision bearing reference to the amount of outstanding debts, the revenue of the company, and the circumstances of the debtors. I arrive at the £15,000 capital required to carry on the business by taking the debts outstanding, £9300, and the stock in hand, £4700, which makes £14,000. When you come to the view of the purchaser, I take another view, and I say he had to buy the stock at an expense of £4600, and to carry on his business till the customers began to pay him. This company have to pay about £21,000 a year. For about four or five months they get no return; they would, therefore, have to lie out of about five-twelfths of their expenditure, which is about £10,000, and you have it again, £14,000. I do not think the debts due to the company have the slightest connexion with the matter. In 1867 the company were altogether due £43,686.

Mr. Davison: How much of that has gone into capital account?

Witness: There is not the least doubt that the whole has; the company had its stock in hand all the time the customers were due on their accounts. Their total capital, including their debts and everything else, as stated by themselves, was £79,000, and that included £11,000 of debts and stock, so that they had £67,000 of capital expended at that time. The actual capital was £26,000, and they had borrowed the rest of the money. Whether they spent that capital in carrying on their works is a matter of perfect indifference.

Sixth Day—Tuesday, May 25.

Mr. *Jamieson* recalled, and cross-examined by Mr. Davison.

In the extract from the balance-sheet, on the 31st of May, 1868, the stock account was £29,687 10s. The £47,000 raised of the new £30,000 at 7 per cent. gives a total of £77,527 10s. On the other side the property and works of the company stood at £74,456 1s. 3d.; and, apart from other charges, they had the coal and stock on hand, £4665 18s. 6d., and in parliamentary and law expenses, £1236 3s. 7d. To defray these their capital resources had been exhausted by about £2000. The only officials of the company I came in contact with in making up the tables were Mr. Macrae and Mr. Mathew.

Mr. Davison: In reference to "General expenses," there is that head running through all the accounts, No. 11 on Table C, in the appendix of March 20—"Abstract of Revenue Account from 1826 to 1868." It is a large figure in the total?

Witness: Yes; £27,643.

Mr. Davison: Does that include plumbers work, repairs on buildings, ouses, works, and general repairs?

Witness: I can only speak in detail for the last four years. Those years contain repairs on offices, workmen's houses, wood, furnishings (iron, oil, tallow, paint, &c.); an old gas exhauster replaced at a cost of £20, and an old boiler replaced at a cost of £69. A part of it is taken off and carried to capital in the last year.

By Mr. Lloyd: I have an analysis of those general expenses for the last four years, which gives a correct statement of them. There are some small items for establishment expenses. The sums contained therein for repairs seem to be purely incidental expenses, such as might be expected under the head of "General expenses."

Mr. Lloyd: Whatever was due to the ordinary repairs and the expenditure in regard to the meters from time to time, would not be properly treated at the capital sum upon which depreciation should be taken?

Witness: Certainly not. I went into the depreciation of the meters to ascertain what would be the fair amount of depreciation to arrive at for 1868, and I brought out, according to that view, £840, which was at the rate of 7½ per cent. I adhere to that rate. Taking the figures now given in on behalf the gas company, the value of meters then on hand was £13,971, and the depreciation on that at 7½ per cent. would be £1047; or taking it at £12,000 (which I believe is nearer the mark) it would be £900 per annum, so that £844 is by no means an over estimate.

Mr. *William Stiven*, examined by Mr. Michael.

I am an accountant of Dundee, and am in a large practice. I have been an arbitrator in cases of accounts, and also a judicial factor. I have for some years audited the books of the Arbroath Gas Company, and am auditor also of the books of the Police Commissioners of Dundee and other public bodies. I examined the books of the Dundee Gas Company in conjunction

with Mr. Jamieson. I have prepared a statement of the capital account of the company. [Statement handed in.] I agree with the evidence given by Mr. Jamieson. I have seen Mr. Ritchie's statement as to the coals carbonized for the four years ending May 31, 1868. The total cost of coals carbonized for the year 1867-68 is £14,946 1s. 2d.; from that should be deducted the cost of fuel, 213 tons, £101 3s. 6d., which leaves £14,844 17s. 8d. The amount as worked out by Mr. Ritchie's figures is £15,129 16s. 3d.

Mr. DAVISON: Now I must have the book the accounts were taken from. Taking the detailed prices given by Mr. Ritchie, it will give the sum I have mentioned; the books show an under-debit for that year of £284 18s. 7d. for coal.

Mr. HAWKSLEY: This witness corrects Mr. Ritchie. That gentleman makes the cost £284 more than this witness.

Mr. MICHAEL: The books show the lesser amount. Mr. Ritchie gives the absolute amount, which is £284 18s. 7d. more than is shown by the books. We must, therefore, assume, as Mr. Ritchie has given every individual item and the prices, that he is correct in carrying it out, and that the books are in error in understating the cost of the coals carbonized by £284 18s. 7d., and I will examine the witness as to how he dealt with that.

Mr. DAVISON: I believe the difference is between what coal is carbonized and what is purchased.

Examination resumed: In the statement showing the actual surplus revenue I have included only the lesser sum debited in the books for coal.

By Mr. DAVISON: It was as an estimate from Mr. Macrae and his assistant at the office—the officers of the company.

By Mr. MICHAEL: Stores were estimated in the same way. The amount of money borrowed by the police establishment at Dundee at the present time is £66,185, at 4 per cent. The Harbour Trust has borrowed about £200,000 at a little under 4½ per cent., or thereby. The security for the police loans is a rate of 1s. 6d. in the pound on the assessable rental of Dundee. The harbour mortgagees have no rate in aid, except the tolls in the harbour. The rateable value of property upon which the police assessment is levied is £349,628 17s. 2d. at present (annual value). The securities for the gas annuities will include—firstly, the gas-works themselves, with all the revenues accruing; and, secondly, an assessment of unlimited amount on all the property in Dundee. In my opinion there could not be a better security in Scotland than in gas annuities. I think they would readily sell so as to yield not more than 4 per cent. The opinion in Dundee, both among bankers and merchants, is universal that this would be a first-class security. Local investments are usually in favour in Dundee. I have gone over the coal contracts entered into by the Gas Commissioners, and have prepared a statement. [Statement produced.]

By Mr. DAVISON: I got this statement partly from the evidence and partly from the contracts themselves.

By Mr. MICHAEL: It makes the average price of coal per ton taken over from the companies £1 0s. 5½d. In the new contracts, my connected statement makes 36,500 tons, the cost £33,607 18s. 4d., and the average per ton 18s. 5d. There were sixteen kinds of coal used by the company in 1868. Six of these are used by the commissioners. In 1867-68 the coal trade was very much depressed. I have seen a "Statement of debts, obligations, and liabilities of the Dundee Gaslight Company, of which they claim to be relieved by the commissioners under 'The Dundee Gas Act, 1868,' under reservation of the company's right to claim further relief in virtue of the said Act and otherwise." In that statement there are paragraphs referring to the relief of the company from contracts with ten coal companies.

Mr. LLOYD said some of those mentioned were cancelled, new contracts being entered into with the same parties by the commissioners; but all that remained now were included in the upper list of "Contracts taken over from companies."

Mr. MICHAEL (to Mr. Ritchie): Have you the contracts here?

Mr. RITCHIE: No.

Mr. DAVISON: These things would be handed over, of course, to the companies.

Mr. THORNTON said the commissioners had not got those contracts. The company had repeatedly been called upon to produce them, and had repeatedly declined. He had not seen a word of those contracts till that day.

Mr. HAWKSLEY: But the commissioners must have had the contracts at the time that they gave the release.

Mr. THORNTON: We did not give the release, we received it. They were contracts at a high rate. It was our interest to be relieved from them; and in making new contracts with the same collieries, we took care to condition that in entering into the new contracts we should get rid of the old.

Mr. DAVISON: That gets rid of the whole thing.

Mr. THORNTON: But to the extent of those eight contracts contained in this printed statement the parties declined to release us. The company served upon us a schedule. Upon getting that schedule we asked them for the contracts, and they declined to give them. We then went to their own manager and secretary, and asked them at what price the coal contracts were. They told us. We saw in the market that the coals were selling at a less rate. Then we said: "It is for our interest and that of the company that we should get those contracts cancelled, and probably if we take our own coal supplies from the same collieries we will get a release both to ourselves and the company;" and in that way it was worked out. It was for the interest of both. But to the extent of those eight contracts we have been unable to do it.

Mr. HAWKINS: Without having the contracts actually before you, you got that information which you relied upon?

Mr. THORNTON: Certainly, and I would rely upon the same information to-morrow.

Examination resumed: I have framed a statement showing the leakage or unaccounted-for gas from 1858 to 1868.

By Mr. DAVISON: I compiled it from the company's books. [The statement was here handed in.]

Mr. DAVISON said he could not allow this. He had a substantial reason, which he could not explain before so many people, for not allowing this to be gone into, especially as regarded one or two years. The meter-book was kept by the manager himself, and must be proved regularly.

Witness: There is a check upon it. There are two officers, one who conducts the commercial business, and the other who manages the business at the works.

Mr. LLOYD said there was no other way of getting at the difference between gas made and gas sold. The book kept by the person who had charge of the meter was adopted by the company.

Examination resumed: I work out the average per centage of leakage from 1858 to 1868 to be 23·261. Beginning in 1858, the per centage was 18·661; 1859, 18·888; 1860, 23·875; 1861, 23·688; 1862, 26·719; 1863, 25·114; 1864, 23·743; 1865, 24·272; 1866, 22·320; 1867, 22·805; 1868, 25·790.

By Mr. DAVISON: I made out this paper myself, and also found out the decimals.

By Mr. HAWKSLEY: This is a general average of the eleven years.

Mr. HAWKSLEY: It is not a general average of the leakage in the eleven years. The proper way to do it would be to cast up the first two columns, and to find what the difference converted into per centage is upon those two columns, then you would get the correct average. It would show a much larger average than the way you described just now. Is this an average of the averages?

Witness: This is the average of the per centages which I found in the company's books, without alteration.

By Mr. MICHAEL: I have taken from the company's books the number of retorts used for the last four years. In 1864-65, the largest number used was 102; in 1865-66, it was 120; in 1866-67, it was 114; and in 1867-68, it was 108. A rise of 2d. per 1000 feet would amount to about £530 upon the gas sold. There was not a corresponding rise in any of the other seven towns.

By Mr. GATES: I was engaged on these accounts, putting all the time together, about three months. The inaccuracy in the quantity of coal carbonized seems to be in not charging a sufficient amount for the coal in the ledger. It is quite possible that the sum of £284 has been omitted to be debited to the coal account in the year 1867-68, and apparently probable from the statement. I think these securities equal to land securities, thereby differing from Mr. Jamieson. I have never lent any of my own, or advised any client to invest any money in this sort of security, although I have in landed securities and house property. The estimate from which the unaccounted-for gas statement was given was framed in October last. There is no particular reason for taking an average for eleven years. I believe some of the 108 retorts referred to in 1867-68 had only been used a short time; I think only for a few days, from the middle to the end of December, but they could not dispense with a less number.

Mr. DAVISON: Here is a query in regard to the public lamps, "Hours or cubic feet?" so that you took it out of the book without knowing.

Witness: The explanation is, that hours are held to be equivalent to cubic feet in charging the gas to the Police Commissioners. There are no meters to the public lamps, and to obviate that they hold that the number of hours is equal to a number of cubic feet.

Mr. HAWKINS: Only one cubic foot an hour to each lamp?

Witness: Yes; I find that in December, 1867, there were 2095 tons of coal carbonized, while the monthly average of the year was only 1087 tons.

By Mr. MICHAEL: Hours and cubic feet come to the same thing. The time the station-meter was unemployed was estimated from the company's books. There were no figures of money carried out in Mr. Ritchie's statement, but merely the quantity of coal, and price per ton. I have appended the figures carrying out the total, and then made a grand total, which I compared with the total in the company's books, and then I found the discrepancy of £284.

Mr. *James Maclaren*, examined by Mr. PHILBRICK.

I am a land valuator and architect in Dundee, and one of the certified surveyors of buildings. In connexion with Mr. Blackadder, I inspected the property, and surveyed the buildings and grounds belonging to the company last autumn, before the works were taken possession of by the commissioners, and made a valuation. The plans, sections, &c., that I have made are all accurate. I have before me a detailed valuation of the buildings, showing their value when new, the depreciation that I would put upon them, and the amount of that depreciation. Taking the whole of the buildings together, the net result is £19,854 4s. 6d. for the buildings as they now stand—that is, the property of Peep-o'-day only, exclusive of land. Taking the land at 6 acres 22½ poles, I estimate the value at 15s. per pole of annual feu duty or rent. That is perpetual, and would capitalize, according to usual practice, at 22 years purchase, giving a gross total of annual value of £7361 7s. 6d., and a capitalized total of £16,211 5s. From that would come the value of an annuity at £45 a year on the life of a lady aged 75, which is £312; and also £3 6s. 8d. original feu duty, which capitalized is £83 6s. 8d., making £395 6s. 8d. the total deduction. The net result is £15,815 18s. 4d. At Scouring Burn I put the ground at £1 a pole, because it is in a different neighbourhood and more valuable than the other. It is 35 poles, and brings out a net capitalized result of £270. From that there is a capitalized sum to be deducted for the annual payment to the town for the right of opening the streets. That is continued by Act of Parliament; it is the annual payment of £20 which the commissioners will have to pay for the future. That is a deduction of £460, which will leave a net result of £15,625 18. 4d.

Mr. HAWKSLEY (to Mr. Lloyd): The difference is in the ratio of about 4 to 1 between you. I want to know if this sum of £20 has been included in your calculation of the annual expenditure of the company or not.

Mr. LLOYD said if he took it at 20 years as a perpetual charge upon the land and works, then, of course, it could not be charged on the goodwill also; but if they were to go upon the question of the net ascertained profits, and capitalize that at a certain amount, then this became immaterial.

Mr. HAWKINS: Except that it ought to be inserted as a trade charge.

Mr. DAVISON: And you will see they have got it, if you turn to the appendix.

Examination continued: The 15s. and £1 a pole is for the land *quà* land, and without any reference to the trade carried on.

By Mr. HAWKINS: Assuming that the gas-works were altogether destroyed and the trade gone, they can sell the land.

Mr. PHILBRICK: With regard to these buildings, according to the price that you have allowed—viz., the cost price of the construction, less a fair depreciation—if those buildings were put up to-day for a similar sum, could better buildings for the purpose of carrying on the trade be erected?

Witness: Certainly. I have valued everything upon the ground, irrespective of its adaptability. Some of the things are actually disused, but I have made no deduction on that account. There are two new gasholders and six old ones. The new ones hold very nearly 400,000 cubic feet, and on Mr. Church's valuation something like £7700 is put down for them. The old ones, which contain 260,000 cubic feet, are put down at £10,760. Taking the six old holders at their cubic contents, and supposing them to be as good as the new ones, at the same proportion they would only come to about £5087, instead of £10,760.

Mr. PHILBRICK here referred the arbitrators to the company's valuation. He said the six old holders were valued at a certain amount, and they contained a certain amount of gas. The two new holders also contained a certain amount, and this witness said that, taking the six old gasholders to be equally good with the new ones, at the same ratio they would only come to £5087, instead of £10,760, showing a valuation of rather over 100 per cent. more.

Examination resumed: These figures are correct as an arithmetical calculation. I have valued the whole of the land at Peep-o'-day, whether covered by buildings or not. In my judgment, for the purpose of carrying on the business as I saw it before the commissioners took possession, there

was no land which might be fairly called surplus land. It was partly covered by stores of pipes and coal, and by railway sidings and a crane. At that time there was a new retort-house being constructed.

Mr. PHILBRICK: Supposing that all the unoccupied land was fenced off and in the market to let, is there space enough for erecting any building which in that locality would be of any material value?

Witness: No; there is too little space for a public work suited to the locality—I mean a block of warehouses, a mill, or any manufactory. The buildings would be purely of a business nature. The area available, assuming the ground to be in part unoccupied, would not admit of the construction of such works to advantage. There is no demand just now in this locality for ground for the purposes mentioned. There are several blocks in the immediate neighbourhood to be let on feu, one being of 7 acres, immediately to the east. The Carolina Port property there is for sale. Immediately to the west is Mr. Neisch's ground of about 4½ acres. To the north is the Thornbank property of about 5 acres. Under the Harbour Act the trustees can reclaim 100 acres of the slob. The larger portion of the ground occupied by the gas-works was reclaimed from the river. This reclaimable land lies immediately across Dock Street on the other side, between the works and the river. Land so reclaimed would be quite as accessible to the town and railway, and be better situated with regard to the docks. There is no surplus land in the north boundary of the works—Ferry Road—which could be used for any practical purpose, because the street there is within the statutory breadth, and no building can be erected without keeping it back.

By Mr. HAWKINS: The statutory breadth is 42 feet.

By Mr. HAWKSLEY: They can compel the widening of the street, without making compensation, the moment the wall is taken down.

By Mr. PHILBRICK: I acted for the gas company at the time of the agreement with the North British Railway Company. Their bill was for a line which would have taken away the whole frontage of the gas-works, and the railway company proposed to get rid of the section in the Lands Clauses Act, which would have compelled them to take the whole if they touched a part of the gas-works. There was opposition on the part of the gas-works; then a negotiation; and finally an agreement between the parties, on which the opposition was withdrawn, and certain terms come to which are in evidence.

Mr. HAWKSLEY: But the bill did not pass?

Mr. DAVISON: Yes, it did, sir; but it was repealed next session.

Mr. PHILBRICK: The agreement, it is true, was never carried on, but the agreement was that the company should only pay what was contracted to be paid before they took any part of the ground, was it not?

Witness: Quite so.

Mr. PHILBRICK: And it was supposed that the works of the railway company would be terminated on Mr. Neisch's land.

Mr. HAWKSLEY said it was not binding on either the commissioners or the company on the date of transfer.

Mr. LLOYD: They have given evidence of the value of land as tested by the price which the North British Company proposed to give, and we explain the circumstance as showing that it had nothing to do with the normal value of the land.

Mr. HAWKSLEY: It was all at an end before the date of transfer.

Examination continued: There was a bill brought in, in the succeeding session, to abandon the line authorized by the Act, which abandonment the gas company petitioned against, and they were thrown out on *locus standi*. The level crossing in Dock Street adds materially to the capabilities of the work, and economizes the carrying on of the business of the gas company. It saves carriage, which otherwise would be an expense against them. It is a public street, over which the crossing runs, and is under the control of the Police Commissioners. If the company lost the right of carriage across the public street, there would be a necessity for larger store accommodation in their own works. They would have to employ the carts in the ground, and store more than they can do with the trucks. They do not quit of it so soon with cartage. They require more room to get carts into the sheds. If the company were to lose the use of the coal-siding which the railway company lets to them, it would again materially affect the requirements as to the ground which now is said to be surplus.

By Mr. DAVISON: I have only built small gas-works for private gentlemen. I valued these same works three years ago, in conjunction with the late manager. I never valued any other works, and do not know if the valuation is the same. There are several ways of valuing. The buildings were not the same then as now; there have been some recently erected. There are rather more than formerly. The basis of 16¾ per centage, for depreciation on the "entrance lodge and store," is got simply by professional experience and the appearance of the building. It is but temporary, with a felt roof, a slight brick wall, and in a bad state of repair. I am more often for railway companies than against them. I know Brown's land; it is to the west of Craig's harbour. There are no docks or harbour up there. There is an access off the street; off the north the ground extends between the railway and the public street. They are not building, that I know of, towards the docks. Trade is bad at present at Dundee, and has been for some time; before the slack time warehouse building was working out that way. Most buildings have been in the outskirts of the town, because the ground is more convenient. They warehouse flax and jute there which comes in the harbour. It is found to be more convenient to keep the material where it is spun, near the factories, than to warehouse it contiguous to the docks.

Mr. DAVISON: Would it not be a convenience if there was land to have a warehouse and a factory in the neighbourhood of the docks where the jute comes to, and near to which the manufactured articles are taken away?

Witness: It is simply a money calculation.

Mr. DENISON: Is not the money calculation the cost of the land?

Witness: Yes. The trustees have still power to claim 100 acres of slob land. Their bill has only passed the House of Commons. It was opposed. They have power to buy or sell it. The Carolina Port is slob. There is not a drop of water there; it is all solid land. There was formerly water there, and on the harbour ground there is some water still. I do not compare that land with that of the old company in its present state; I compare it after it has been reclaimed. I was for the railway company in Brown's case. There was about 157 poles there. I do not remember what I valued the buildings at three years ago, because it was mixed up with the manager. I am prepared to swear to that valuation. I valued the buildings, but cannot recollect whether I valued the land. I have often been here and in parliamentary committees. I valued Brown's land at 10s. a pole three or four years ago. Mr. Fulton was on the other side. I do not know whether he valued the land at £3 which I put down at 10s. Mr. Fulton is in the room. I do not know if he is here as a witness for the commissioners. He may be on other business.

Mr. LLOYD: Mr. Fulton is not here as a witness on our side.

Cross-examination resumed: My figure for Brown's land was 10s. a pole at 22½ years purchase, which is £1766 5s. There is no comparison whatever between the two. I valued the whole of Brown's land, house and all, at £5200. The jury gave a verdict for £5014. I know Bruce's Dundee Soap-Works. The land was sold for 60s. with buildings on it. I know Jessamine's wood-yard. There are large buildings on it now; I don't know that he gave 60s. for it. I know Clydesdale Bank and Trades Lane. The small piece at the corner was 50s. The old lady with the annuity of £45 a year, whose age is 70, has to live seven years, in my calculation. I do not know if 77½ years is the average life for a lady. I took Mr. Church's figures to illustrate my opinion as to the maintenance of the works, as I am not a gas engineer. I took them all as to gasholders. The tanks and wharves are in my department, and the holders are the engineer's. The town authorities have never prevented the company having access to their works. The company have a title to their works, and have a physical access to them. They are more valuable with it, but they cannot be sure of keeping their rails. The railway is projected a little further west, and in the same way. The 40 feet height of embankment is ¾ ft. across the ground from east to west. Opposite the manager's house there are large terraces; there are two terrace walls, and west of that is a rock. I advised the gas company that they could not do without the slice of land they were going to sell to the railway company, and they refused to take money for it, and only agreed to take three or four times the amount of land which was required for the railway, and a sum of money over and above. There was nothing on the land at that time, except a small porter's lodge. There was the stock of pipes, &c., but no buildings. The company agreed to sell it. As far as I could judge they could not do without it by any possibility.

By Mr. HAWKSLEY: The land was precisely in the same condition, as regards the gas company, then as it is now. Most gas companies buy land adjoining their works with regard to future extension.

Mr. HAWKSLEY: Was any disposition of this temporary part of it due to its value to the company for the extension of their works, or to their immediate necessities?

Witness: I believe it was partly both, but, no doubt, chiefly the extension of their works.

By Mr. PHILBRICK: Whatever may be the per centage or number of years purchase put upon this fact of access across Dock Street by the railway, it makes a very material difference in the valuation of the property if it has an accommodation of this sort by right, instead of a precarious title and a matter of permission.

By Mr. DAVISON: Messrs. Loch and Maclaurin were agents for the company. The North British and Tay Bridge Railway Company were No. 4. I have valued the land now 6 acres 22 poles.

Mr. DAVISON: Did you not value the land in 1866 at £44,942, and the buildings, which you have said were less than they are now, at £34,730?

Witness: I do not recollect.

Mr. DAVISON: Look at the fact [handing a paper to witness]. This is valued on the principle that the railway company were to take the whole works of the company.

Mr. HAWKINS: Did it include anything for business?

Mr. DAVISON: Not a farthing, sir.

Mr. HAWKINS: "The old gas company possesses about 6 acres 17 poles of ground." He values this ground at £7360 per acre, making £44,942; and the buildings at £34,730, making a total of 79,672. This is simply for lands and buildings, and he does not value the plant.

Mr. DAVISON: That is as against £15,625 *plus* £22,916, which is his valuation to-day.

By Mr. PHILBRICK: As to this valuation, I only valued buildings and land; and on the principle of its being a compulsory sale, the railway company taking the whole of the land, and stopping the works, I took into account that the company were making extensions of their lines, and that there was a competition between the two lines, and also that such competition would prevent any ground being acquired by the gas company for the replacement of their works.

SEVENTH DAY—WEDNESDAY, MAY 26.

Mr. *James Maclaren* was recalled, and explained, in reference to the precognition, that the valuation was made in London from data furnished him by the manager. It was done in an off-hand way, and not by details. It was made by cubing the contents of the building off, a ground plan, with the height, &c., having been sent by the manager. The object of the valuation was to show the magnitude of the works, and the interests which were interfered with by the two railway companies, who were then promoting lines in Parliament to take the ground. He did not go over the details personally at the time.

By Mr. POWNALL: The valuation which I have submitted now is the result of careful investigation, and the other was not.

By Mr. HAWKSLEY: The property at the time of the transfer was in working order. I have valued some of the feu duties (the original ones) at more than 22 years purchase, because the greater the security, of course, the lower the interest taken for a feu duty. Feu duties are a charge on the income of the company in one sense; they are a first charge upon the land and buildings. The feuer, in default of payment of feu duty, could enter upon the property and sell it.

Mr. HAWKINS inquired whether the £45 annuity was to remain a charge on the works after the annuities were settled.

Mr. THORNTON said it was, and as it still had to be paid over and above the annuities, it was deducted.

Mr. HAWKINS: Supposing you have property which yields £10,000, if there is a charge on that of £50, which the annuitant is entitled to receive, it does not signify what the property is applied to, the annuity is worth so many years purchase.

Mr. HAWKSLEY: Supposing it is a charge which is only available upon profits of the company?

Mr. THORNTON: It is created a real burden upon the land by the deed which I put into Mr. Hawkins's hands. If you do not pay the annuity we can enter upon the land, and sell anything thereon to pay the annuitant. If the annuity runs into arrears for two years, I can go to the Court of Session and get back my property by act of declarator.

Mr. *R. Blackadder*, examined by Mr. LLOYD.

I am a civil engineer and architect in Dundee. I have been assistant valuator for that town, and have had to value the gas-works for rating purposes more than once. I have gone carefully through the estimate given in by Mr. Maclaren. We went over the buildings together, and measured every particular detail about them, and fixed a price to it according to the same price a tradesman would require to erect the works.

By Mr. POWNALL: I agree with the preceding witness as to the value of the works and the allowance for depreciation.

By Mr. LLOYD: I agree also with Mr. Maclaren's valuation of the land. The rating for 1866-67 was £2186, and for 1867-68, £2649.

By Mr. HAWKSLEY: That is on net rateable value. The assessment was made under the new Scotch Valuation Act.

By Mr. LLOYD: The ratable value was made up from the balance-sheets of the company furnished by themselves. They complained that the amounts were too high.

By Mr. HAWKSLEY: The increased valuation of the property was objected to on the ground that we were assessing them at a higher rate than the clear revenue of the company.

By Mr. LLOYD: I was not permitted to assess the vacant ground as a special property. Their objection was that there was no surplus ground; that it was all required for the undertaking. The gross rating valuation for 1868-69 was £6111, ending May 31, 1868, and was made up from the balance-sheets furnished by the company themselves, being nearly three times as much as I had before. The rates of assurance upon manufacturing premises vary from 21s to 23s. per cent. on the amount of the policy; I mean upon flax and jute manufactories. Upon ordinary jute and flax warehouses the average rate is about 8s. It would not be at all safe or prudent to erect such buildings in the immediate neighbourhood of gas-works. They would not be insured. I am not aware of any insurance on gas-works in Scotland.

Cross-examined by Mr. DAVISON: The largest works I ever engineered are the water-works at a mansion near Dundee and at a farm-steading, and the improvement of the river Dean. That is not a navigable river. I do not know whether Mr. Fulton is to be examined as a witness or not. I was a witness, in the case of Brown's lands, for Mr. Brown. I have never erected a gas-work. I first valued gas-works in 1866. In valuing for rating I deduct nothing for renewal or depreciation. I have tried to raise the rating of these works every year since 1866, and have each time succeeded. The company are not satisfied with my valuation; they thought it too high, even after it was reduced a little.

Re-examined by Mr. LLOYD: I was appointed assistant valuator by the magistrates on account of my special qualifications for it. I have valued nearly all the mills in Dundee, and suppose I have had more experience in that than any one in Dundee.

By Mr. HAWKSLEY: My valuations are technical, and according to the Scotch Valuation Act, which prescribes that the valuation shall be made of the interest of the landlord in the property occupied by the tenant. The tenant's profits are deducted from this valuation. The landlord is to maintain the works, and we value them at their gross rental. Any deduction for repairs must be done by the landlord out of his rent.

Mr. *W. Foulis*, examined by Mr. MICHAEL.

I am a gas engineer, residing in Glasgow. I have had much experience in the management and erection of gas-works. I am familiar with the value of gas property, and have made a careful valuation of the Dundee Gas Company's plant, pipes, &c. The total plant and pipes, including tools, I make £18,402, from which I deduct for depreciation £3860, which leaves as their present value £15,042. Street-mains, £28,420; depreciation, £5684; leaving £22,736. Services, £9000; depreciation, £750; leaving £2250. Malleable iron pipes, £2000; depreciation, £1000; leaving £1000. Public lamp services, £2625; depreciation, £1312 10s.; leaving £1312 10s. Meters (for the first cost), £20,322 16s. 6d.; depreciation, £7869 19s. 5d.; leaving £12,461 17s. 1d. Total, £54,802 2s. 10d. The works are not arranged as one would like to see them. They are very much over-crowded, and require considerable repair and renewal. The retort-house contains 50 ovens with three retorts, and one of them five retorts; in all, 155 retorts. The bottom retorts are oblong in section, 1 foot 9 inches broad, 1 foot 1½ inch high, and 8 feet 8 inches long. The top retorts are D-shaped, 2 feet 7½ inches broad, 1 foot 1½ inch high, and 8 feet long. Each setting of three retorts is capable of carbonizing 5 cwt. of cannel coal in three hours, or 2 tons in 24 hours. The maximum power of production, at 10,000 feet per ton, is about 1,050,000 feet in 24 hours, and, allowing one-sixth for spare retorts to meet contingencies, 900,000 cubic feet. The greatest quantity produced in one day last winter was 780,000 cubic feet, and the largest consumption of gas in one night was 908,000 cubic feet. I have the age of the benches here in detail.

By Mr. DAVISON: I got it from a book kept by the manager.

Mr. DAVISON: You must produce the book.

A discussion here arose as to the admissibility of the book as evidence.

Mr. HAWKINS inquired if it was worth while to press that evidence.

Mr. LLOYD: I will withdraw it.

Examination resumed: There are two kinds of condensers—one horizontal, and one perpendicular pipe condenser of the ordinary construction. The total cooling surface is 10,000 square feet. It is scarcely sufficient in the winter. I have repeatedly seen the tar being pumped over by the circulating pump at the ammonia purifier in large quantities, which I do not think would have been the case had the condensing power been sufficient. There is only one scrubber or ammonia purifier, which I consider a very imperfect part of the apparatus, and quite inadequate to the work. Much of the ammonia must pass that vessel, and is absorbed in the wet-lime purifiers, and of course lost. An alteration was contemplated. A portion of the necessary material is on the ground, and was valued as stores. The stores are included in the valuation. There are ten wet-lime purifiers, eight small and two large. I consider them quite inadequate. The eight small ones are 15 feet long by 10 feet broad, and 10 inches deep at the inlet-end.

By Mr. HAWKSLEY: They are too small for the quantity of gas that passes through them.

By Mr. MICHAEL: The inlet and outlet pipes are so low that the agitation of the water in the wet-lime purifier washes the lime over into the pipes, and they get choked up as a necessary consequence. It causes a deal of trouble in the winter months. Another defect in these purifiers is that they cannot be reversed. The gas must pass constantly in the same direction through one purifier only. There are five double dry-lime purifiers. The total purifying tray surface is 5000 square feet. With the wet-lime purifiers at present it is no more than adequate; but I certainly should be inclined to allow a much larger proportion of purifying surface than seems to be allowed at these works. The purifiers are not well arranged. The result of the gas being able to pass through only one purifier before it comes to the station-meter, is that a large quantity of lime must be necessarily thrown out before it can be used. My opinion, generally, is that the whole of the purifying apparatus wants complete rearrangement, and in many parts renewal. There is one exhauster with 15-inch connexions. I think a duplicate is necessary. There are two gasholders 100 feet in diameter, each capable of containing 370,000 cubic feet. They are comparatively new and in good condition. There are three holders 60 feet diameter, containing each 50,000 cubic feet, and one 47 feet in diameter, containing 32,000 cubic feet. Those last four are old, and little value can be attached to them. One of the 60-feet holders was much injured in December, 1865, by an explosion in the boiler. The connexions for these last four holders are too small for the present night consumption, being only 9 inches in diameter. They can only be used during the day and the morning, they cannot be used at the time of the maximum consumption. These holders are imperfectly guided. The bottom pulleys work against the stonework only. The latter seems much indented and worn, and consequently the pulleys shake about a good deal. The 47-feet holder has only three light tripod columns guiding it, and it seems to be a really dangerous thing.

By Mr. DAVISON: This is all included in deterioration.

Mr. LLOYD: This is not simply a matter of deterioration.

Examination resumed: There are two naphtha and one ammonia stills, with worms. Many parts of that apparatus are in a very defective state. The ammonia still is completely worn out, and the malleable iron cisterns are in a similar condition. There was an explosion in that part of the apparatus on February 29, 1868. I think this apparatus too near the other portion of the works, and danger may be apprehended from its contiguity. I have examined the mains. They have been opened up in 15 places. At six of the places they were in good condition. At five the metal was soft, and resembled plumbago. I could cut it off with a knife. At the three other places they were similarly affected, though not to the same extent. The mains were most affected in the busiest parts of the town, which contained the largest amount of piping. The cast-iron service-pipes were in a similar condition. I applied a test to a ¾-inch cast-iron service-pipe attached to the main, and it was broken by a slight tap from an ordinary hammer. The two district gasholders at Durdhope are of very little service at present, because a large 18-inch main, which was laid down a few years ago, supplies that district. There is, too, a deal of trouble in working those holders. There is no independent main from the works, and they are obliged, by heavy counterbalancing weights, to lessen the pressure of the holders so as to be able to lift them when they want them. Once, when I visited Dundee, I found that a large section of the works had been stopped for some hours in consequence of a stoppage in the overflow tar-pipe, which runs alongside the main-line, and the tar in the pipe, in consequence of the pipe, had become hardened. That was not a good mode of construction. In my opinion there is no surplus land. I consider it is all required for the purposes of the works.

Cross-examined by Mr. DAVISON: I have not valued any works in Great Britain, although I am familiar with the prices at which works can be erected. I think the new Glasgow Gas-Works cover more than 6 acres of ground. I dare say they produce twice the quantity of the Dundee. I do not remember the exact figures. There would be no difficulty in making three times the amount of gas made at Dundee upon the 6 acres, but before that could be done an entire reconstruction and rearrangement would be necessary. The railway tramways of the old company approach the frontage in Dock Street. I have seen the whole of that ground [referring to plan] covered up with pipes, coke, and coals. There are no works more permanent than the porter's lodge upon it. The purifying apparatus is about the worst thing upon the works. The value of a retort fixed, including everything connected with it, is about £22 at the outside.

By Mr. HAWKSLEY: I mean a retort about 8 feet long and 18 inches diameter; that would make 7000 cubic feet per day from each mouthpiece. A through retort, open at each end, would make 14,000 feet.

By Mr. DAVISON: The single retort would cost about £22. The retort itself would be £3. I have put the "Ironwork in retort-house" at £917. Then there is "Main stack, £422." The retort benches are not included in those items. The £422 has nothing to do with retorts. The "Large retort-house, £1372;" "West end of ditto, £696;" "East end of ditto, £322 10s.;" comes to £27 per retort, which includes the stack and retort-house. When I spoke to the value of a retort as fixed, I did not include the roof. It is slightly less than £9.

By Mr. HAWKSLEY: I did not make up the valuation of the benches; that was done by local men. They are included in the building of the retort-house; 115 multiplied by £22 is £3410, which is the value of the retorts as fixed in their benches. The whole of the items amount to £4194.

Mr. HAWKSLEY: But that includes the whole of the buildings, *plus* the benches. Now deduct that £3400 from the £4194, does not that leave less than £1000 for all the buildings which enclose these retorts?

Witness: That certainly would seem to be the result here, but I cannot really speak to those figures at all. I do not know where they are.

Mr. LLOYD: Each retort costs £27, with the buildings and all, according to our valuation.

Mr. HAWKSLEY: Then you would put it that there is only £5 per retort to be attributed to the building?

Mr. LLOYD: In answer to a question, Mr. Foulis put the value of a retort at £22. It is not the result of the figures before you at all.

By Mr. DAVISON: I would not say £5 a retort was enough for the roof; it depends on the style.

Re-examined by Mr. MICHAEL: I give the cost of the retort at £3, and the gross ironwork £6. I estimate the total cost of providing a retort, incidental ironwork, and the bench, at £20, which leaves £11 for the brickwork. If these figures work out £27, that leaves £7 for the roofing and side walls. The present roof is corrugated iron. I suppose its value is about 12s. a square yard. It is a circular roof. The side walls are stone. They are not open at both ends; they have open doors, but they are closed all round. My depreciation is taken off the whole quantity.

By Mr. HAWKSLEY: I have not made a valuation. They have made 143 million cubic feet, and can make it yet. If the works were altered as I would alter them, there would be a diminution in the amount of wages and in the quantity of materials used. The gasholders being disadvantageously worked involves a greater outlay of wages. Taking this as a going concern, that outlay of wages is a disadvantage paid for in the result. I believe with a proper rearrangement of these works 3 million cubic feet could be manufactured.

Mr. *T. Buchan*, examined by Mr. LLOYD.

I am a land valuator and surveyor. I am the senior magistrate of Dundee, a Harbour Trustee, and a Police and Gas Commissioner. I am of opinion that Mr. Maclaren and Mr. Blackadder's valuation of the ground of 15s. a pole is a fair price. I look upon the security which is to be given for these annuities as first class. The commissioners of Dundee Harbour have nearly £200,000 borrowed just now at 4 per cent. There is nothing but the security of the harbour rates and revenue, and no assessment upon the town to secure it. The Gas Commissioners borrowed £40,000 at 4 per cent. There is there the security over the gas-works, and an unlimited security over the assessment of the borough—the same security as these annuities will have practically. The Police Commissioners borrow at 4 per cent. very readily. I know Dock Street. The coal-sliding next the railway was obtained from the Harbour Trustees, and it can be resumed on a month's notice. As far as I can recollect, 1s. 2½d. in the pound was levied on the

gas-works in 1867-68 for general purposes, 3½d. for sewage, and 1½d. for roads.

Cross-examined by Mr. DAVISON: I have not taken much interest in the gas-works. I have attended some of its meetings. Provost Hay is chairman. I am a member of the Finance Committee. Our accounts were made up to the 30th of April last. The commissioners made an estimate that year, and one also for the six months. I am not aware whether I was in the chair at that time or not. I estimated for the twelve months £45,900 as the revenue for the year beginning the 11th of November, 1868, and ending the 11th of November, 1869. That is for both companies. I also estimated for the six months from the 11th of November, 1868, to the 30th of April, 1869, the gross revenues of the two companies at £28,600 The expenditure for the same year was estimated for the two companies at £47,909, including the annuities, £10,309 0s. 6d., and £1000 sinking-fund; and for the same six months £26,804 10s. 3d., including for those same items £5154 10s. 3d. for annuities, and £500 for sinking-fund. [Mr. Davison here referred to the examination of Mr. Thornton respecting the correctness of the revenue and expenditure account of the company. An extract from the *Dundee Advertiser*, containing that document, was then put in.]

Mr. DAVISON: On the revenue side, the items are the quantities of gas supposed to be sold at 5s. 4d.?

Witness: Yes.

Mr. DAVISON: The meter-rents at the rate of 1s. 6d.?

Witness: Yes.

Mr. DAVISON: The coke account at the market price of the day, and also the chemical products, naphtha, ammonia, and tar. On the other side you have the "Coal account, including supervision and labour, purifying, retorts and setting, maintenance of apparatus and building, fuel for steam-engines, oil and small stores, and miscellaneous disbursements; main-pipes, services, and connexions, including the necessary small stores, and labour connected therewith; enclosing gas-works—wall on east boundary; meter account, new meters to be purchased, reconstructing old meters; also wages of men, inspecting and shifting meters, administration of commission, collection of revenue, &c.; assessments, taxes, &c.; rents, feu duties;" and then come the two items, which, of course, must come off in ascertaining your net revenue—"Interest of mortgages" and "Annuities in terms of Statute until correct amount be fixed;" "Sinking-fund." Now, your accounts, published the other day, run from the 11th of November to the 30th of April?

Witness: I cannot tell.

Mr. DAVISON: That is your estimate [pointing to newspaper paragraph]?

Witness: Yes.

Mr. DAVISON inquired if the other side declined to let him put figures to them, which were the result of the six months working.

Mr. LLOYD: We do not admit that.

Mr. DAVISON inquired if they would produce their accounts. He did not think that any one arbitrary year was to be conclusive as regarded the working. He would ask the arbitrators if, after all they had heard about the tumble-down gasholders, and explosions, and valuations here and there, they would be content to make their award without knowing what those gentlemen had been doing with it in their own hands during the last six months.

Mr. HAWKSLEY: Suppose you got that account for six months, are you prepared to contrast it with a similar six months of the company's working?

Mr. DAVISON: I will contrast it with anything—with the six months in which they say we altered our accounts, and did not honestly make them.

An argument here ensued as to the value of the document in question as evidence.

Mr. HAWKINS said that Mr. Davison having given notice to produce the document, if it was not produced he might have secondary evidence of it.

Mr. LLOYD: I have not got it.

Mr. DAVISON: We have it.

Mr. THORNTON (to Mr. Hawkins): This copy of theirs contains only one-half.

Cross-examination resumed: I see that the meter-rents are £710 7s. 4d., which, as compared with an estimate of £900, is a falling off. £1055 8s. 2d. is shown in the statement as the actual receipt for the six months. The chemical products appear as having produced £2028 9s. 9d., as against £900 estimated.

Mr. LLOYD objected. He said Mr. Davison was referring to two documents, the result of which would be entirely misleading. It was unfair to put those figures as the evidence of Mr. Buchan, who knew nothing about them.

Mr. DAVISON said he had to make a comparison between what he had got and what was produced at the last moment, which had been previously done *ad nauseam*.

Mr. HAWKINS said if the witness could vouch for any figure, he could explain the difference between one statement and another, and then unquestionably he must be asked about it; but from that paper he would simply say that it was established as the account of the commissioners, otherwise further evidence was idle. He thought counsel wanted to prove it beyond that. By that paper the commissioners might not, of course, be bound. The question was whether it was evidence or not.

Cross-examination resumed: I valued Brown's land at £2 a pole, as against Mr. Maclaren's 10s. I think I was right. The Harbour Commissioners have a sinking-fund of £2000. It is possible they may have borrowed small sums at 5 per cent. There was an abundance of applications at 4 per cent. They amounted to £72,000, but we declined to take large sums. There is always plenty of money in Dundee. Buildings have been checked lately. I heard the other day that some new factories were being put on.

Re-examined by Mr. LLOYD: Brown's case is different altogether from the present case. If I thought £2 right then, I think 15s. right now. I know nothing personally about these accounts.

By Mr. HAWKSLEY: I think we could have borrowed cheaper if we could have had a longer term. If the money was in the nature of a perpetual investment I think it would make this difference, that the annuities would float at less than 4 per cent., because they are a marketable commodity, and no trouble is given to the parties who have these annuities. In properties where the money is lent on first-class security, and where from 4 to 4½ per cent. is paid for it in Dundee, they have the opportunity of having it returned from five to seven years, as the case may be; but in the Police Commissioners, where the money is secured by the rates, the money floats at a very cheap rate indeed. In Dundee, where large and small sums are lent out from five to ten years, the charge is from 4 to 4½ per cent. If I was a trustee, and it was legal, I should invest in these securities, because they are the best in Scotland.

Thomas Greaves Barlow, Esq., examined by Mr. LLOYD.

I am a gas engineer, and also a civil engineer, and have practised in those capacities about 35 years. I visited Dundee in October last, and carefully inspected the works. I made a valuation according to my usual principles, and the only way in which I ever acted. I ascertained the sum which I considered to be the net earnings of the undertaking. I first take the gross earnings, and then deduct from them the expenses, and also sufficient to cover the depreciation which does not occur annually, and having ascertained the net amount, I capitalize it at a certain number of years purchase. That gives me the actual value, taking the structural value and the plant. The structural value only enters into the calculation with a view of ascertaining what is a fair allowance to be made for depreciation. There are two depreciations to be allowed for—viz., the future and the past. In my account I have taken the year ending May 31, 1868, the year before the transfer. I have taken Mr. Guild's figures. £9740 is his, but subsequently he corrected it by £124. I make certain deductions, the first of which is that I charge that gross profit with 6d. a ton which the company save by means of this tramway, to which they have no legal right. They are merely possessors of it by the permission of the corporation or the Police Commissioners, which can be withdrawn at any time, and I cannot conceive how the corporation or the Gas Commissioners are to pay for that right. The 6d. a ton would be the increase of coal on 13,249 tons, which makes £331 4s. 10d. The general expenses and repairs of works Mr. Guild has set down at £579 14s. 3d. I have analyzed the accounts for four years preceding that period, and I find that average to be £710 7s. 9d., which gives £130 13s. 6d. excess as worked by Mr. Guild. There is no doubt the company did as little as they could in the shape of repairs, therefore I have taken a four years average. I have not deducted the directors fees, on the ground that if the directors do not give their personal superintendence, other officers or clerks must be employed to do it. I find, on the four years average, the bad debts account has been 1¼ per cent. upon the rental—viz., £469 3s. 7d., being £159 5s. 3d. more than Mr. Guild deducts. The four years average on the cost of service-pipes and repairs has been £263 1s. 10d.; Mr. Guild's amount is £106 7s. 7d., so that this is a surcharge of £156 14s. 3d. on that score. The repairs and renewals of meters I have taken at 5 per cent. on their first cost, which comes to £1047 2s. 10d. per annum. A large company of which I am consulting engineer, who have about the same number of meters as this Dundee Company, have a contract with the manufacturers to keep them in repair and restore them for £1850 a year.

By Mr. POWNALL: That would be something like 8 per cent.

By Mr. LLOYD: Deducting from that the amount allowed by Mr. Guild it comes to £907 11s. 6d. I understood Mr. Guild to say, in his evidence before a committee of the House of Commons, that he put down 7½ per cent. for meter renewal in the Dundee Gas Company. I have taken the rates and taxes at 8s. 7½d. in the pound on an assessment of £2180. In my judgment they are liable to be assessed at that sum, and I think they have been assessed at £1800 or £1900. I have taken the risks and casualties at 1 per cent. on the gas-rental. In some cases there is considerable risk; the naphtha stills and chemical apparatus are adjoining the purifiers, and there is great risk of explosion from their proximity. That is the usual allowance. Then there is £125 insurance of stock, being 10s. per cent. upon £2500. I take interest at 5 per cent. on the current capital, which, putting it at £10,000, is £500. That is the floating capital. The party carrying on the undertaking must have sufficient funds to pay the outgoings till the quarter's rent becomes due, and he must have a sufficient sum to pay for the stock in trade. I take 1 per cent. upon the estimated value of the buildings, plant, mains, and service pipes, for renewal and reproduction fund. The total of these corrections of Mr. Guild's account is £3787 18s. 5d., which, deducted from his estimate, leaves a net profit of £5952 2s. 7d. I capitalize by multiplying it by 20, as I conceive that 20 years purchase is the correct time for property of this description. I have never known more than 20 years given. Of course, there is a difference between companies with and companies without statutory powers, but a company without fetches from 18½ to 20 years. I do not find that competition makes any difference in the intrinsic value of this kind of property. In London you do not get above 15 years purchase, because pressure is brought to bear which could not be brought to bear in the provinces. In December, 1867, I found 108 retorts were in action, and I think that 16 should be kept in reserve in case of accidents, making 124—making 31 retorts in excess. I estimate those at £22 10s. a retort, making £697 10s. I add £480 for retort-houses appertaining to those 31 retorts. The total working capacity of the gasholders is 922,000 cubic feet, but two of them contain 740,000 cubic feet, and those are the only ones which have really any value for the purpose of the light supplied. You could only practically use two. The smaller ones may be used after midnight and in the daytime, but not during the heavy hours of consumption, because the inlet and outlet pipes are too small, and the gas cannot be got through them without an enormous loss of pressure. In a town like Dundee you ought to have a gasholder room equal to 24 hours consumption. Two-thirds may do in London and other places where there is no mill consumption, but there is a very large quantity sent out between six o'clock and sunset—two-thirds of the whole consumption. The greatest quantity produced in the winter of 1867 appears to have been 780,000 cubic feet, and that, as compared with 920,000 cubic feet of gasholders, gives 135,000 feet of surplus storeage; and the half of the cost is £3858.

By Mr. HAWKINS: The land occupied by the surplus retorts and gasholders is £750, making total value of the surplus plant £5785 10s., which, added to the other amount, makes the total value of the property, if new, £124,825 10s.

By Mr. LLOYD: I have given nothing for surplus land beyond the 1200 yards occupied by the gasholders, because every portion of that land is required for the purposes of the undertaking. In October they were stacking their winter stock of cannel on that land. A plan here shows that there are tramways from the siding, for the purpose of bringing the trucks alongside, and the cannel was stored on that spot. If the works were constructed over again they could be disposed of differently, but at present that part of the land is absolutely necessary for carrying on the undertaking. I have adopted Mr. Maclaren's estimate, and the other witnesses, as to the depreciation on the plant, buildings, mains, service-pipes, and meters. I always make that deduction myself. In order to earn a revenue steadily year by year it would be necessary. The whole calculation is based upon the works being new when taken at 20 years purchase. I have made many inquiries in Dundee, and, seeing what the commissioners have already at 4 per cent., and have had a large additional sum offered, I do not think the annuities should bear a higher rate of interest than 4 per cent. I think they would be saleable at par, or a little above. That would be dividing this gross sum by 25, which would give £4076, which is the value of annuities to be given to the company. If they had chosen to take a capital sum the amount, would have been £101,909. As to the value of gas shares, it varies with the rate of dividend paid as to the number of years purchase. The higher the dividend the lower will be the number of years

purchase, and *vice versâ*. If they pay a low dividend, there is a prospect of getting a higher ultimately. With an average dividend of 10 per cent. in companies with parliamentary powers, the amount is 17·7 years purchase. There are cases where it is 21 or 22 years purchase, and there are others where it is only 15. I do not agree that £7 is an adequate price to allow for wear and tear of a retort. These are very large retorts. Mr. Spice's figures, perhaps, may have applied to 16 or 18 inch retorts; but taking these, two of them are 21 inches wide, and the top one is 31½. I do not think that a bed of three retorts can be restored for less than £30, being £10 per retort. £36 is an absurdly small estimate for 12,000 service-pipes, and the £106 is not much better. The company only spent the latter amount last year, but still that is not a fair average. It is only something like a halfpenny a pipe per annum. They put £141 for meters, which gives something like 120 years as its life. It is admitted, on the other side, that 15 years is about the life of a meter, and in Dundee I think they will hardly attain to that, for in a great many instances instead of being of block, they are only made of sheet tin. The sheet, of course, will not have the duration of the block tin. My estimate of 5 per cent. brings the life of a meter up to 15 years. I think the company were perfectly justified in not taking the meter-rents in their account as part of their profits. In my opinion they amount to little more than is sufficient for a meter. The Dundee meter-rents are very low, and the surplus very small. In Glasgow and the City of London no meter-rent whatever is charged, it is all put in the price of the gas. The meter-rent in the last year was £1217. My estimate for repairs is £1047, leaving a very small surplus; that is taking it at 5 per cent. My recent engagements have led me to direct especial attention to the prices of Scotch cannels.

Eighth Day—Thursday, May 27.

Mr. *Barlow* handed in the following statements referred to in his evidence yesterday:—

Corrected Revenue Account, for the Year ending May 31, 1868.

Balance of profit as given by Mr. Guild, subject to the following corrections, to arrive at the value of the undertaking to the company				£9,740	1 0
Saving of 6d. per ton on the delivery of 13,249 tons of coal by the tramway laid across Dock Street by permission of the corporation			£331 4 10		
General expenses and repairs of works at 1·62d. per 1000 feet of gas sold, being the average of four years, as stated in the company's accounts	£710 7 9				
Less the amount allowed by Mr. Guild	579 14 3				
			130 13 6		
Directors			284 0 0		
Bad debts at 1½ per cent. on the net gas-rental, being the average of four years	£469 3 7				
Less amount allowed by Mr. Guild	309 18 4				
			159 5 3		
Service-pipes and repairs at 0·6d. per 1000 feet of gas sold, being the average of four years	£263 1 10				
Less amount allowed by Mr. Guild	106 7 7				
			156 14 3		
Repairs and renewals of meters at 5 per cent. on their cost	£1,047 2 10				
Less amount allowed by Mr. Guild	140 11 4				
			907 11 6		
Rates and taxes, on an assessment of £2180, at 3s. 7½d. in the pound	£389 6 0				
Less amount allowed by Mr. Guild	336 14 11				
			52 11 1		
Risk and casualties, at 1 per cent. on the net gas-rental			268 8 0		
Insurance of stock-in-trade, buildings, and apparatus, at 10s. per cent. on £25,000			125 0 0		
Interest at 5 per cent. on a floating capital of £10,000, employed in carrying on the undertaking			500 0 0		
Renewal and reproduction fund, at 1 per cent. on £77,250, the estimated value of the buildings, plant, mains, and service-pipes, when new			772 10 0		
				3,687 18 5	
Corrected profits for the year 1867-68				£6,052 2 7	

Mr. Barlow's Valuation of the Undertaking, based on the Corrected Revenue Accounts for the Year ending May 31, 1868.

I value the undertaking as a property producing a net income of £6052 per annum, at 20 years purchase (subject to deductions for dilapidations as hereunder), with an addition for surplus plant not yet brought into profitable occupation—say, £6052 at 20 years purchase is				£121,040	0 0
Add for surplus plant—					
There are 155 retorts set, of which 108 were in action in December, 1867, and 16 additional ones should be kept in reserve for use in case of accident, making 124 required, and leaving 31 surplus, worth £2 10s. each			£697 10 0		
Add proportion of retort-house, in the ratio of 31 retorts to £2400, the whole cost of the retort-house			480 0 0		
The total working capacity of the gasholders is 920,000 cubic feet, but only two of them, containing 740,000 cubic feet, are of any value for the night supply, as the inlet and outlet pipes of the others are too small to transmit the quantity of gas passing into the town after sunset. In a manufacturing town like Dundee the capacity of the gasholders should be equal to 24 hours production, as the greatest portion of the gas is consumed between sunset and six o'clock in the evening, when the factories close, the greatest quantity produced in the mid-winter of 1867 being 780,000 cubic feet. I am disposed to allow 135,000 cubic feet, or half the contents of the gasholder last erected, as surplus storing power, at half the cost of the entire gasholder—viz.			3,858 0 0		
1200 yards, or say 40 poles of land, occupied by the surplus retorts and gasholders, at 15s. per pole, capitalized at 25 years purchase			750 0 0	5,785 10 0	
Value of the property if new				£126,825 10 0	
I make no allowance for any other surplus land, as I believe the whole to be required for carrying on the works; and it appears to have been so considered by the company, or they would have sold it and divided the profits as one of their assets.					
Deduct—					
For the depreciation of buildings, plant, mains, service-pipes, and meters, as per detailed valuation				22,916 10 0	
Present value of the undertaking				£103,909 0 0	

If payment had to be made in money, the company would have, in my opinion, been entitled to receive £103,909 for their undertaking; but as they have preferred to take payment in annuities, I think they are only entitled to receive such annuities as this capital would produce at the current rates in Scotland for annuities as thoroughly secured as these are by the Dundee Gas Act. I consider the security to be equal to Consols, and will be saleable at 25 years purchase. By giving annuities equal to the net profits, the company will be getting a premium of 25 per cent. upon the present value of their undertaking; and as the commissioners had three times the amount they required offered at 4 per cent., I think the annuity should be such a sum as £103,909 would purchase at the same rate per cent., or £4156.

Mr. Davison applied for the production of the books and balance-sheet of the commissioners.

Mr. Hawkins said, in the present stage of the inquiry, he could not order the production of the books for Mr. Davison's inspection; but the arbitrators had it in their power to listen to any application from him, at the end of the commissioners case, with regard to any fresh evidence.

Mr. Lloyd, after a short consultation with his clients, said he thought the best plan would be to go on as before, and leave the arbitrators to exercise their own discretion hereafter. He would take the risk of that afterwards, rather than incur the present heavy expenses.

Mr. *Barlow* further examined.

Mr. Lloyd: You perceive that it is stated that a reduction of the price of coal would make a great difference in the results of the profits of working. Do you think that it is enough to take prices of coal without ascertaining what the quality of the coal was which was to produce the gas?

Witness: Certainly not. I have taken some trouble to ascertain what per centages of different classes of cannel were used in the year 1868, as compared with those purchased by the commissioners, of which we have had an account. I find that of the first-class cannels there were carbonized, in the year 1868, 29·65 per cent. The first class of cannel coal is the most productive in point of quantity and quality. The commissioners have purchased of that quality only 11·27 per cent. Of the second class of cannel there was carbonized by the company 23·99 per cent., and the commissioners have purchased 11·27 per cent. The company carbonized 19·98 per cent. of the third class, and the commissioners have purchased 16·9 per cent. The company used 4·39 of the fourth class, and the commissioners have purchased 50·7 per cent. Of the fifth class the company used 21·99 per cent., and the commissioners have purchased 9·86 per cent. The effect of this would be that, having purchased a larger portion of inferior coal, they have got it at a reduced price, and the gas has been of an inferior quality. The effect of pressing coal to get the largest number of feet of gas from a ton would be to reduce its quality. The year ending May, 1868, does not show any appreciable increase in consumption compared with the preceding one.

Mr. Lloyd: But even assuming that there was an increase, and that increase was likely to continue, does the 20 years purchase upon the net ascertained income of the year cover the whole of that?

Witness: It does; especially taking into consideration that, at the period of the sale of the undertaking, the shares were only at some 18·8 years purchase, and I take them at 20. I have not allowed anything for unaccounted-for gas. In the account that is before the arbitrators of the unaccounted-for gas during the last 10 years, there has been a slight increase in the last year, but that is apparently due to another cause. When I visited the gas-works I found that the water-line of the station-meter was half an inch above what it ought to be; the consequence of that would be to increase the apparent make of gas, and I do not believe that it even was really produced; and I believe that this increase from 22·8 per cent. to 25·79 per cent. between the two periods is due to that cause. For a series of years that leakage (with the exception of last year) has been tolerably steady. If the company thought there was anything in it, and that they could by any arrangement of their mains reduce that leakage, they would have done it themselves. If I thought that, by spending £5000, I could reduce the leakage to half, I should have done so, and got the benefit. They have done nothing of the sort. I do not apprehend that the leakage is to be reduced considerably, except by laying entirely new mains. The item in our valuation for mains is £28,420. I do not think the leakage excessive, as a large portion of the pipes are laid in a soil in which they decay very rapidly, from the saline mixture. I know a great many large towns where the leakage is larger, and many unsuccessful attempts have been made to reduce it. Before the last new gasholder was brought into action they were deficient of gasholder room, and they had to employ a larger number of retorts than they had subsequently. Two years ago they had 120 retorts in operation instead of 108. They have been able to reduce that 12 by means of the increased capacity obtained from the new gasholder. The gasholders at Scouring Burn are in a very unsafe condition. The person in charge of them complained to me of the danger there was from the decay of the frame and apparatus by which the weights were taken off from the gasholder, seeing that, to enable them to fill the gasholder, a counter balance weight of about 12 tons had to be applied to reduce the pressure, and the apparatus for doing that was in a very unsafe and perilous condition. I believe that the maximum price of gas of 5s. 4d. has been strained to the very utmost limit; that the increase took place in consequence of an advance in coals, and that if the coals had been reduced to anything like the price stated on the other side, a corresponding reduction in the price ought to have been made. I do not believe that otherwise the public would have stood the paying of the 5s. 4d. The effect of making the estimate on the basis which I have taken has been to give the company the full benefit of that. 5s. 4d. is an excessively high price in Dundee. Cannel coal is relatively considerably cheaper than in other places.

Mr. Hawksley: The maximum price is 7s. or 7s. 6d., if you are speaking of London, and the actual price is 5s. 6d.

Mr. Davison: But that is not 26-candle gas.

Mr. Lloyd: But if you had the same quality of coal to produce that quality of gas in London, the price would be much higher than the same coal in Dundee?

Witness: Yes. I was surprised that the Dundee public so long stood that charge, and that a similar agitation was not set on foot by the gentlemen on the other side, such as has been done in Brighton. I have no doubt, if some gentlemen I know had interfered in the matter, they would have got the price reduced to 4s.

Cross-examined by Mr. Davison: I do not adopt the plan of structural value with three years tenant's profits to arrive at the value. I do not think it gives the full advantage to the owners of the undertaking about to be sold. There are companies in London charging 3s. 4d. and earning 10 per cent., but their shares are not worth a greater number of years purchase than the others.

Mr. Davison: I ask you, with reference to this, is it an element in valuing a gas-work to know whether they are under the Gas-Works Clauses Act, and limited to a 10 per cent. dividend, or not?

Witness: No; I have not taken that into consideration. I should not conceive that that would have any effect upon it, because, although the company might be unlimited in their powers of paying dividend, I do not believe that the public would stand it. I think that a company which is

bound to make, say, 30-candle gas, and one which has just got an Act requiring it to sell 40-candle gas without a limit to its dividend, are in the same category. I do not know if the company have ever carted coal since the railway came there.

Mr. HAWKSLEY: How long has that railway been down?

Mr. THORNTON: They got the siding in 1861.

Mr. HAWKSLEY: I am thinking of the crossing of the street by the railway.

Mr. THORNTON: It was in 1861.

Cross-examination resumed: I did not take the average of the general expenses themselves, they are so mixed up together. In one case you get general expenses; in another, it is partly repairs of works. They are both in, but under two different heads, and I prefer to consolidate them under one head. The amount of £309 18s. 4d. for bad debts for last year is not our statement. I took this from the balance-sheets. I see in the balance-sheet for the year ending May, 1865, that there was an allowance of £500 for bad debts. In the next year there was a further allowance of £500. At the time I made that estimate I had not the accounts that Mr. Guild has put in subsequently. There was £500 that year; the same amount the next year; and then it seems to have been ascertained that that £500 was in excess; and in the following year, instead of a charge, there was a credit of £48. Then, in the following year, there was £281 written off; and then I have been informed an additional £419 was written off. Mr. Stiven told me that was written off on the realization of the company's assets. I make the average bad debts from those four balance-sheets £247 18s. I think 1¾ per cent. on the net gas-rental is a large per centage. I put it at what my figures worked out. The shareholders must pay the £284 for directors; it is a charge upon the undertaking. I have never seen this bad debt book before. [Book produced by Mr. Davison.] My abstract was got from this paper [pointing to a paper]. The bad debts, according to that book, are, for 1865, £215 8s.; 1866, £224 0s. 9d.; 1867, £242 5s.; 1868, £309 18s. 4d.

Mr. STIVEN: We have gone over the accounts, and we do not agree with this valuation.

Witness: All I can say is this: from the information I have had given to me, I do not accept the figures of this balance-sheet.

Mr. DAVISON: Do you accept the bad-debt book?

Mr. STIVEN: That is an abstract of the consumers ledger, and not a bad-debt book.

Cross-examination resumed: I have never seen that book before, and was not aware of the existence of a bad-debt book. In reference to "Service-pipes and repairs," which I have put down at 6d. per 1000 feet sold, I have taken that the same way as the general repairs and expenses, on an average of four years. I think the whole cost of service-pipes, either new ones or renewals, should be charged on the revenue. I do not include new pipes for new consumers. I do not know if the item I have given includes that. If it contains service-pipes for new consumers, it should come off. I have never seen any of the company's books; all I have seen is the abstract. I prepared this form [pointing to Table B], and asked Mr. Stiven to fill it up from the books, and he has done so. This is not a capital account, but a revenue account. If they were new services to new consumers they would be in the capital account.

Mr. HAWKSLEY: Can any one tell us how many new consumers were put on in those four years? Then we can form an opinion of the cost of the service-pipes for new consumers.

Mr. DAVISON: We have had it that in the last year there is only an extra make of half a million.

Mr. HAWKSLEY: On an average, is 500 new customers about the thing? I can imagine that might be about it in such a place as Dundee.

Mr. DAVISON: I cannot give you evidence of that; my case is closed.

Cross-examination resumed: The meter-rent in Dundee is low—about 6 per cent. In London it is 10 per cent. on meters up to a certain size only—up to 5 lights. The difference between 6 and 10 per cent. on all the consumers in Dundee would be about £800 a year; 10 per cent. would be a fair thing—5 per cent. for repairs, and 5 for renewals. The average of four years would not be fair in this case, because I am taking these meters as new, and raising a fund to repair and renew them as they wear out.

By Mr. HAWKSLEY: If you have 150,000 meters of all ages, and the life of a meter is 15 years, 1000 meters would have to be renewed every year. The average cost of meters in Dundee has been about 27s. The cost of the 1000 would be about £1350.

By Mr. DAVISON: With regard to rates and taxes, the company are assessed at less than their real value, and they ought to have been, and are liable to be, assessed at a higher sum. If you claim a large sum in respect of the increase of consumption, and then, on the other hand, you claim the full present value of the surplus plant, you make no deduction for that. I take £9740 1s. as the balance of profit for the year. The rating is not increased, but is on the present value of the property in 1868; £2180 is my own calculation as to what the rateable value is. I put "Risks and casualties" at 1 per cent. on the net gas-rental. That is usual in valuing gas-works. I do not recollect doing so in the Peterborough case. The total figure in my estimate for the chemical apparatus and structural value is £1574. In a statement put in by Mr. Spice, the tar, naphtha, and sulphate, together, are taken at £2062; but I cannot separate them—that is for a year. The tar would have to come off, and that would be about a third of the value of the chemical products—say about £700. The apparatus could be put elsewhere on the same premises. There is nothing else which is specially dangerous but what would be covered by the ordinary fire insurance. There is no difference between these and ordinary works on this head of "Risk," but you must remember that this £268 does not cover solely risks and casualties of the works, but there are risks and casualties of carrying on the trade; you may have an escape of gas in the house, and get in for enormous accidents. There is no land where the apparatus could be put, except a part of what you call "the surplus land." It would cost, in the rough, about £600 to remove it. I do not recollect, in any case in which I have acted for the seller, ever allowing 10 per cent. on the plant for insurance of stock in trade. The usual plan is to take half a year's gross expenditure for floating capital. In Peterborough I put it on £10,000—that is, the outgoings, *plus* the necessary stock in trade. The commissioners, when they took the works from you, paid £2642 for stores; that forms part of the capital required to carry on the undertaking. I was, in a great measure, guided by the capital which I found the company to have employed, as shown in their balance-sheet of May 31, 1868. The figures there show that, under "Stock in hand," there is, first, £4665 for coals, and they have £9307 outstanding accounts for coals and secondary products; that makes £13,972 which was due to them. Then, on the other side, debts due by the company, £3874; that is just £10,098 of capital which they had, according to this balance-sheet, employed in carrying on the undertaking on the 31st of May, 1869; and I am further confirmed in that by the fact that the company had £16,529 of assets, which they could have collected after Nov. 11, and £2642, making together £19,171, out of which, I believe £7000 was money: so that it left about £12,000 of actual floating capital employed in carrying on the undertaking.

By Mr. HAWKSLEY: That includes the rental. It is the rental due at the period. If they were to let the works, the tenant would have to pay that outstanding rental.

Mr. HAWKSLEY: Suppose a company starts suddenly into existence with a large amount of custom, and that it gets no rental of course for the first quarter or half year, then the company would have to find the coals and wages for that period?

Witness: Yes; and, on the other hand, that would be diminished by the amount of fair liabilities, in the nature of debts not paid at the moment, which would remain at the end of the quarter. The difference, then, irrespective of rental altogether, would be the amount of money which the company would have to obtain from its bankers, or its share capital, or in some other way. The amount will be found in this manner: This account for 1868 shows that the total sum expended in the year is £21,299. Of that £1345 is interest, and has to be struck off; that leaves about £20,600 as the year's outgoings for earning the income. I say that six months of that the tenant, or whoever carries on the works, should have at command. This company, I believe, collect four times a year. The six months expenses are £10,300, and then you have to add to that this stock of £4665, which the general account shows to have been in hand.

By Mr DAVISON: I think the difference between £2600 and £4000 would represent the value of coals and coke. I have not taken off residual product receipts from the gross expense of the £10,300. It leaves £9120, and then to that you must add the £2640 of stock; that makes £11,760 In taking £10,000, I have taken £7500 as necessary for carrying on the undertaking, and £2500 as the value of the stock. The whole of it will be required in the winter quarter; there may be a surplus in the summer. I do not think, in a calculation of this sort, that 4 per cent. trading profit is sufficient: therefore I have charged 5. The renewal and reproduction on the £77,250 is the whole of this inventory and valuation of Mr. Foulis, excluding the meters. My depreciation of £772 10s., taken at 20 years purchase, would be £15,000 odd; that agrees with Messrs. Foulis and Maclaren's figures. My £772 is future depreciation, and the £15,000 is past depreciation; it is to maintain and reproduce the plant, so as to keep it up to its original value for the future. The value of the existing plant and works is depreciated to the extent of £22,916 by reason of past dilapidations; but then, to cover future dilapidations, I take 1 per cent. on the original value. It might be done in another way, if, instead of taking the £77,000, the value of the new, you were to take the £54,000; then you would alter the rate of per centage. Respecting surplus plant (retorts), I generally take 15 per cent. The roofing is of the commonest kind possible; it stands on rubble walls: £450 is certainly an ample sum for the roof. The £1372 includes the arches for retorts. I should think £8 a retort would cover it. I have allowed for £22 10s., but I should tell you that is an excessive amount. I do not wish to be hard on you. The difference would work out about £3 10s. The £750 is for the land upon which the 31 retorts stand which are not wanted, and half the land on which the gasholder stands. There is land toward Dock Street on which there are no permanent erections. It is used for storing cannel coal, and pipes, and other things necessary for carrying on the undertaking. The extra retorts will be wanted some day or other. We are proposing to pay you now, and it may be years hence before we want them. I think there ought to be storeage room for one-half per centage of coal as a general rule; that would be 6625. The company were in possession in October. There was at Dock Street, at that time, the turntable, with rails laid here [referring to plan], and this was occupied with cannel. There were pipes.

By Mr. HAWKSLEY: They were pipes which had been taken up—new pipes and branch pipes.

By Mr. DAVISON: There is nothing to prevent this being built on [referring to plan]. It is covered with nothing except the boundary wall. I would not allow for this as surplus land, because it is necessary for carrying on the works. I have valued the land where the retorts actually are, because it is surplus. You must have a stock of pipes on hand for repairs, but not absolutely for extensions.

Mr. HAWKSLEY inquired if the question was not substantially upon how many acres could 143 million feet of gas per annum be made. If there was only enough ground for that purpose, there was no surplus, and if there was more than enough, there was some surplus.

Mr. DAVISON said he had the answer from Mr. Foulis's evidence, that it could be done on those 6 acres, if things were properly arranged (and as to that he would ask them to see for themselves), with three times the business.

Cross-examination resumed: Having arrived at £6025, and having capitalized it, they are to have the security which is available at 4 per cent. I may have had a different opinion when I was before the committee in May, 1868. What I state is from information from other people, guided also by what I have ascertained as the value of annuities sold in this manner. You find in the great railways 4 per cent. debenture stock sells at par, and sometimes at a little above, the London and North-Western for instance. It is a question of security. I expect the commissioners will make a profit over and above what is necessary to pay the debentures. It is not a revenue above the £6052, it is the £4100 odd—£6052 is the net revenue. They are to make no more than that, and I doubt if they will make so much.

Mr. HAWKSLEY: Under the hypothesis of this valuation they will get it?

Witness: That is if they maintain the present price of 5s. 4d. The commissioners will no doubt see the necessity of reducing that price.

By Mr. POWNALL: In addition to that there is the contingent-rate to an unlimited extent.

By Mr. DAVISON: A man who does not get paid must go to law. The Midland Railway debentures, I think, are raised at 4 per cent. I believe the London and North-Western, Midland, and the North-Eastern all get their money at 4 per cent., and I think the New River. I was in the Glasgow gas case on the part of the corporation. They are paying their maximum dividend of 10 per cent. on one class of shares, and 7½ on the other. They are limited to 10 per cent. I advised the corporation what to offer them, and ultimately the company accepted the offer. It was 9 per cent. for the 10 per cent. shares, and 6¾ per cent. for their 7½ per cent. shares in the shape of an annuity; but for that we get the whole assets of the company, including their reserve-fund. It includes £40,000 in money and £12,000 in house property. The shareholders were under the Gas-Works Clauses Act, and could not get more than 10 per cent.

By Mr. HAWKSLEY: The capital of the Glasgow Company is only £215,000, and we get works on which they have spent £488,000.

Mr. DAVISON suggested that as he should apply at the end of the case for

the books, and it was possible his application would be conceded, that they should telegraph for them to-morrow.

Mr. THORNTON: Probably it would answer the purpose if Mr. Mackenzie had access to the books at Dundee. If our books are here we cannot carry on our business. We have, I dare say, 200 books, and are at the present moment collecting our gas-rents.

(To be continued.)

Miscellaneous News.

BRITISH ASSOCIATION OF GAS MANAGERS.

(Continued from page 502.)

Mr. ESSON read the following paper:—

ON A SUBSTITUTE FOR THE HYDRAULIC MAIN.

In describing a method of relieving the retorts from the pressure entailed upon them by the seal of the dip-pipes in the hydraulic main, it is fair to say that in the early days of gas lighting, and until exhausters were used, such an arrangement made ample and most efficient provision for the attainment of the object in view. Although, however admirable in many respects, yet the unfounded fears of some turned them into formidable impediments to the production of gas, by making the dip-pipes too long, and thereby immersing them too deeply in the liquid contained in the hydraulic main. Now, there is no need of saying, before such an audience, how injurious this is to the retorts—how it lessens the yield, and increases the fuel and the cost of production. The custom of supporting the hydraulic main in the brickwork forming the retort-stack has greatly contributed to this, inasmuch as difference of level when in and out of action leads to the increase of dip, that blowing may be prevented. It is doubtful whether that be the proper position for the hydraulic main. Although the change of temperature cannot be prevented from altering the level of the stack, there seems really no difficulty, either on the ground of cost or difficulty in construction, in altering the position of the hydraulic main so that its level may be maintained. It has been demonstrated in practice that the extremities of the dip-pipes, placed nearly on a level with the overflow, are capable of maintaining an adequate seal when the level of the main is maintained. In so arranging the relative levels of the dip-pipes and overflows, the seal, although thus very much diminished from what has been usual, yet the head required to effect the overflow forming seal enough, still opposes a barrier that had better be removed. Such an alteration will, however, effect a saving of about 10 per cent. on the rate of production obtained on the old system of 2-inch and 3-inch seals.

It is alleged that the impediments offered by the seal in the hydraulic main can be easily overcome and neutralized by the exhauster. Why resort to such an agency when simpler and less costly means will attain the same end. It is long since valves have been used instead of an hydraulic main. Spinney, of Cheltenham, used an hydraulic valve, and others common cocks. Common cocks would give trouble by getting fast; and the tarry formation collected in the hydraulic valves at fair heats was speedily converted into pitch, which rendered their removal for cleaning a frequent and not very agreeable operation. Although these were thus attended with practical difficulties, yet the attempt pointed in the right direction. The drawing exhibited and model placed on the table show a form of throttle-valve and connexion that has now been on trial for many years, and has been found free from the objections before mentioned, and has answered the purpose well. It is usual to work the exhaust at zero, so that the gas as driven off by heat in the retorts flows onwards to the exhauster easily and without pressure. The absence of all pressure reduces the fuel account, increases the yield, makes richer gas, lessens wear and tear, and otherwise reduces the production account. The valve consists of two pieces—the chamber and stopper. It is opened and shut by means of a lever moving a central rod working the stopper through a stuffing-box. The lever forms a cross on the end of the stopper-spindle, having on one end a small cast-iron ball, and on the other end an iron rod reaching down to the stoker. The rod on being pulled and kept down opens the valve, and on being loosened ascends by the gravity of the iron ball on the other end of the lever, and so shuts and keeps shut the valve. The valve is inserted between two flanges formed to receive it on the pipe from the retort. When the retort is at work the iron rod is pulled down and hooked on to a catch attached generally to the retort-lid. The rod, when the retort is to be drawn and again to be charged, is unhooked, and the counterbalance overbalances the lever and shuts off the gas.

Mr. SMITH (Droitwich) exhibited drawings of a dip apparatus which he had used in some small gas-works in Shropshire. The apparatus consisted of a wrought-iron box, 2 feet 4 inches in length, 1 foot in width, and 1 foot 3 inches in depth. This box is divided transversely by a partition extending to within 2 inches of the bottom. Into the smallest portion is inserted the dip-pipe, and into the other a plunger made of stone. When it is desired to work without the dip, the plunger is raised by means of a lever, which is hooked on to the cross-bar of the retort. The gas then rises without any pressure. When it is desired to open the retort-lids, the plunger is unhooked and lowered, by which the dip is raised to any required height, there being a gauge on the chain attached to the lever for regulating its elevation. This apparatus was in use from about the 10th of September last till the 14th of April this year, and it was then found that very little scurfing was required in the retorts. The front half of the retort was entirely free, it then began to scale very gradually towards the back, and at the back arch there was a thickness of about 2 inches. On the pressure-gauge being attached to the hydraulic main it was found that the maximum pressure with the dip was 5 inches. On being relieved of the dip it was reduced to 2 inches. The apparatus was altogether satisfactory in its working. Mr. Smith exhibited also a drawing showing an adaptation of the old hydraulic valve, in which the box is very much smaller, and the liquid is brought up to the dip-pipe instead of being forced up by a plunger, so that it is believed there will never be the slightest danger, and the adjustment may be made according to the dip required. No experience had been had with this arrangement.

Mr. SIMPSON (Rugby) asked the previous speakers how they took the pressure from their ascension-pipes. He had found great difficulty from the unsteadiness of the gauge in taking any reliable pressure from the hydraulic valve. In Mr. Esson's plan there would be only the hydraulic pressure. In his own case he had tried the following plan:—He fixed one of Walker's downward valves, feeling assured that the less dip he had in the hydraulic main the better for the retorts. The valve gave a range of 3 inches; it was so fixed as to have 2 inches play, and it was worked so that the tar came down half an inch at a time till the valve was completely closed. He had worked all through the last winter with the valve in that state, with a dip of only half an inch. The gasholder pressure was 3 inches, which came to 4 or 5, and sometimes even higher than that, at the hydraulic main; and yet he had found no inconvenience with the rising of the hydraulic main, which was perhaps 50 or 60 feet. He believed they were labouring under a mistake in supposing that so much dip was required in the hydraulic main. With reference to scurfing, he remarked that he had never adopted clay retorts till last winter. They were lighted up on the 1st of September, and, with the exception of half an inch in the front part of the retort, just under the ascension-pipe, they had never been scurfed yet. As far as he could judge, he would prefer this mode to the one proposed by Mr. Esson. Unless the work was done instantaneously, without reference to Mr. Esson's throttle-valve, there was a liability of throwing heavy pressure on the retort. If it were only necessary to overcome half an inch dip, he did not see why the old method was not quite as serviceable.

Mr. WOODALL (Stockton) said for some time past he had attached the greatest importance to the removal of pressure from the end of the dip-pipe, for his experience had been that very much of the annoyance consequent upon the working of retorts was due to the quality of the coal. With the same section of hydraulic main, and with similar ascension-pipes, he had known retorts worked for six months together without the latter being at all choked, whereas in other works he had had to employ a man to do nothing else than to unchoke ascension-pipes. He had himself adopted a plan which he believed to be superior to every other he had heard of. He divided his retorts into sections, each bed having its own distinct hydraulic main. The ascension-pipe was taken in at the bottom, and he employed Spinney's valve, with the exception that he put several cups into one box. By that means he had a larger area of tar, and a convenient mode of drawing off and refilling; and, during the four months the plan had been in use, he had not noticed the slightest disposition in the tar to congeal into pitch. The cups were worked by a lever, which had a compensating weight upon it, of about 30 lbs. For fear that there might be some difficulty through the tar congealing, he had introduced a diaphragm running the whole length of the main, consisting of a thin plate of iron attached to the ends of each box, extending to within two inches of the bottom, and coming above the overflow about one inch, so that the liquor which ordinarily ran off first could not do so, and the thick tar remained at the bottom in the simplest way possible.

Mr. PATERSON (Warrington) said the subject was one which had been brought before the association on more than one occasion, and was pretty well familiar to the members. He had a very strong opinion as to the advantages of the mode of doing away with pressure suggested by Mr. Esson, and he attached much importance to the general principle of reducing pressure in the entire system of retorts. Scurfing, no doubt, had its advantages, but no one could shut his eyes to its disadvantages. One could not begin to scurf a retort without doing more or less injury; and when it became so much carbonized as to require the use of chisels to take off the deposit, it was just as much as the retort was worth to carry on the process. There could be no doubt, however, that the process was necessary where exhausters were not used; but there could be equally as little doubt that, where they were used, the best mode of reducing the pressure entirely was to adopt the principle which Mr. Esson had brought under the notice of the association. In his own works the total pressure upon the entire retorts was reduced to simply that of the seal of the dip into the main, which was about 7/10ths. He had not, however, as yet taken advantage of the perfection of the system, nor realized all the benefits of which Mr. Esson's plan was capable; for he had no hesitation in saying that, by removing the pressure entirely from the retorts, they would work under the best possible conditions as to the quantity and quality of gas produced.

Mr. G. ANDERSON said he had for some time adopted another plan of doing the same thing, and that was simply to drop a ground ball on to a ground surface. The ascension-pipe on the side next the hydraulic main was ground, and into that was placed a ball which was also ground, and that ball was suspended from a rod passing through a stuffing-box, the man opening and shutting on the same principle as in the other case. His object in adopting that plan was, of course, to reduce the pressure, but not for the reasons already given. He had had an idea for some time that it was inexpedient to thrust into fluid the crude gas, which at the moment was almost itself in a fluid state, and which, if kept from fluid, would become elastic. His impression was that if they had no hydraulic main at all, they would have more fluid gas than by plunging it into water. He might also state that about fourteen years ago Mr. Croll took out a patent for retorts, in which this formed a feature, and it was done in a somewhat similar way to that which he had described—viz., dropping a ball into a ground socket. It seemed, from what had been already said, that if they could do with half an inch of pressure there was very little advantage, as far as pressure was concerned, to be gained from any of these contrivances. He was not, however, prepared to say that half an inch was sufficient; it appeared to him to be but very little if the hydraulic main should alter its level at all. He found, however, in constructing the hydraulic main, that if it were supported on the division walls of the beds, and had no bearing on the arches, it did not get out of the level. He thought, as Mr. Esson used an exhauster, he could obtain by that means every advantage gained by the opening and shutting of the valve; indeed, he was not quite sure but that the exhauster was the best plan of doing it, inasmuch as both balls and valves were apt to be not always quite tight. The plan exhibited by Mr. Smith was ingenious; it arrived at the end sought very readily, and obviated the danger arising from valves not being always tight. There was an objection to this system in large works where there was a very heavy pressure, and where wet purifiers and washers were arranged. But in small works, where there were no exhausters, the simple expedient of using a stone plunger would enable them to raise the water at will, and get a dip which could be easily regulated.

Mr. ANDREWS said he thought the prettiest invention in use in the retort-house, and the one which deserved universal praise, was the hydraulic main; it was so simple and self-acting. He deprecated any invention which involved additional labour or additional foresight on the part of the men at work in the retort-house. He had himself worked Spinney's plan, which was very much like that suggested by Mr. Smith, only that instead of the cup being drawn up it was let down; but he had done away with it, and now adhered to the hydraulic main. A great deal of the incrustation of tar on the hydraulic main was due to the mistake of not having sufficiently large dip-pipes in the first instance. The ascension-pipe was a most important part of the apparatus, and if managers, in altering their retort-houses, were to enlarge their ascension-pipes, a great deal of the evil now so often complained of would be remedied. He had lately put up ascension-pipes 5 and 6 inches diameter, and when building another retort-house he intended to put them up of 8 inches diameter, if he could afford space, and also the room in the hydraulic main.

Mr. DUNNING (Middlesborough) questioned whether there was not as much loss as gain when they came to deal with apparatus which involved the necessity of attention on the part of the men. The danger, of course, in a valve of the kind mentioned, where an exhauster was used, was the

liability of drawing in air, and if a small quantity of air was drawn in a large quantity of gas was spoiled. He was, therefore, decidedly in favour of ascension-pipes, properly constructed, and the old hydraulic main.

Mr. BRADDOCK (Oldham) thought sufficient importance had not been attached to the hydraulic main. As generally constructed, they were much too small. It was a matter of great concern to have a sufficient surface, so that a very little lowering of the level of the water in the main would fill up the pipes to withstand any pressure that might come upon them.

Mr. ANDERSON said there seemed to be a feeling in the minds of some of the members that small pipes and stopped pipes were necessarily coincident—that the one was the cause, and the other the effect. Now, he did not believe that the smallness of the pipe had anything whatever to do with the stoppage of it, except that, if the pipe was very small, it might be warmer, when passing the same quantity of gas, than a larger pipe. He had had a great deal to do with stopped pipes. When he was connected with the Great Central Gas-Works they had 14 retorts in a setting, with very long pipes, some of them meandering 20 feet beyond the warm beds. So many of these pipes got stopped that it became an element of cost. He therefore had a good many opportunities of forming an opinion on the subject, and he tried many expedients to overcome the difficulty. Amongst others, he wrapped the pipes round with a spiral of ropeyarn, and applied water to the top, allowing it to trickle down. This was an amelioration, but not a cure. He tried putting a pan of water in front of the mouthpieces when charging the retorts, and that also was an alleviation. He sometimes had the pipes taken down, when he found them filled with a solid mass of pitch from one end to the other. On examining this mass, he found, at times, that it was not wholly pitch, but contained cavities in which there was soot. He had adopted the plan recommended, of putting up larger pipes, but found that this was no cure for stopped pipes; it simply resulted in the prolongation of time required to effect the stoppage. The result of his experience was that where exhausters were used there was a greater tendency to stopped pipes than otherwise, and that if gas managers worked their retorts not at too high a heat—*i. e.*, such a heat as would make pitch—they would have no danger of stopped pipes.

Mr. WOODALL said his experience did not agree with Mr. Anderson's, for he found that the hydraulic was liable to fall in the middle, and it was there they got most stopped pipes. He found that the number of stopped pipes was just in proportion to the depth of the dip, and in cases where the dip was not more than half an inch he had scarcely known a choked pipe.

Mr. DUNNING said at Middlesborough they worked very high heats and four-hour charges, and had done so for the last fifteen years, and he never had much trouble with stopped pipes until they put up enlarged works, when, under the advice of an engineer who was more sanguine than himself, the size of the ascension and dip pipes was decreased. The result was that they had stopped pipes the whole of the first winter. There was also a deposit of the stiffened-up matter in the hydraulic, which gradually accumulated till that, too, was stopped. The difficulty was overcome entirely by increasing the ascension-pipe and dip-pipe to 6 inches, and there had been no trouble in this respect since, although, as he had stated, they worked at very high heats, and they used coal which was very liable to make pitch.

Mr. METHVEN was happy to say that his experience was contrary to that of Mr. Anderson. At one time, with very small pipes at his works, he had many stopped pipes. On the occasion of rebuilding the beds, he made them the same size, with the same number of retorts in each, but the dip-pipes which had been 3 inches he increased to 4, and the ascension-pipes which had been 4 inches he increased to 5, and on the outlet of the hydraulic he turned a Donkin's valve upside down. He was inclined to believe that there was a very close connexion between small pipes and stopped pipes, though he believed a good deal might be done to prevent the stoppage of pipes, by keeping the retorts full charged and working them off regularly. He found stopped pipes frequently arose from the fact that the retorts had undercharges, and consequently there was no heat in the ascension-pipes, so that the tar which passed up them became pitch before it reached the hydraulic main.

Mr. MILES said he had had great difficulty with stopped pipes, and had found a remedy in having the bottom of the ascension-pipes cleaned every time the retorts were charged.

Mr. ESSON having expressed his satisfaction at the conversation which had followed the reading of his paper, said he had been troubled a good deal with naphthaline at Cheltenham, and he had adopted the plan recommended at the last meeting of the association, for keeping the gas for a long time in contact with the tar and ammoniacal liquor. He found it very effectual, the naphthaline being almost entirely got rid of.

Mr. ELDRIDGE read the following paper:—

ON A SELF-ACTING LIGHTING AND EXTINGUISHING APPARATUS INVENTED BY MR. E. PRICE.

Mr. President and Gentlemen,—You will remember that our president of last year, in the course of his inaugural address, alluded to two instruments which had been recently invented for the purpose of lighting and extinguishing public lamps, and said, "Though both are very ingenious, I fear that neither of them, in their present condition, is practically applicable."

It is one of these—viz., that invented and patented by Mr. E. Price, of the Hampton Court Gas-Works—that I beg to bring under your notice; and although the impression made upon the mind of our late president does not appear to have been a favourable one with regard to its utility, I venture to submit that, a considerable number having been in action for more than twelve months past, the invention is not only practicable, but the use of it likely to become highly advantageous to all who adopt it. I shall occupy your time only a few minutes, and will first describe the instrument, and then endeavour to show its advantages.

The patent lamplighter is a small instrument somewhat similar in appearance to an ordinary lamp-governor, having an inlet in connexion with the vertical lamp service-pipe, and furnished with a flexible diaphragm, which is acted upon by any additional pressure of gas beyond that to which it has been weighted, thus giving motion to a valve which is above, and not below, its seat, as in the ordinary lamp-governor, so that when the pressure is put on at the works the valve opens instead of closing, and allows the gas to pass to the burner. In the chamber beneath the diaphragm an opening communicates with a very small jet burner, for the purpose of supplying a supplemental light. This small jet, not being controlled by the valve, is constantly burning.

When the pressure is put on at the works in the evening, the valve opens, and allows the gas to pass to the burner, which is instantly lighted by the jet. When the pressure is reduced at the works in the morning, below that to which the diaphragm is adjusted, the valve entirely closes, and the gas is extinguished with the exception of the small independent jet which is left burning. The diaphragm is, of course, weighted to suit the pressure of any particular locality, and a small copper shield is used to protect the jet from the wind and wet.

The advantages claimed by the inventor are:—1. The lighting of the lamps need not be commenced so soon by an hour and a half at night, and may be extinguished an hour and a half earlier in the morning. It is generally understood, as a rule, that all lamps must be alight at dusk, and remain so till sunrise; it is necessary, therefore, to commence lighting an hour and a half before dusk, and be equally late in the morning before they are all out; but by this plan the whole can be lighted in the course of a few seconds at dusk, and also extinguished as quickly in the morning. It will at once be evident that there must be a considerable saving of gas. Of course the whole of the lamps will not be burning an hour and a half too early in the evening, nor too late in the morning, because the last lamps to be lighted and the first to be extinguished will burn but little longer than the time contracted for; but it is fair to assume that the whole burn three-quarters of an hour too early at night and too late in the morning. However, to be on the safe side, I take it that by this method half an hour may be saved both night and morning, equivalent to an economy of 5 feet of gas per lamp per day. Pursuing the calculation, it will be seen that the gross saving of gas per day is 5 feet, deduct from this 3 feet, the amount consumed by the jet burner in 12 hours, and you have a net saving of 2 feet per day; this, multiplied by 365, gives 730 feet per lamp per year, or 73,000 feet per 100 lamps per year. Taking the gas as costing 2s. per 1000, this will be equal to £7 6s. per 100 lamps per year.

2. A very considerable saving in lamplighters wages. Assuming that the cost of lighting, extinguishing, and cleaning is 12s. per lamp per annum (a rather low estimate), and that the cleaning alone may be done for 4s., it follows that two-thirds of the wages will be saved. Putting this into figures, and reducing it to money value, it will stand thus:—100 lamps at 8s. = £40, add to this the saving of gas £7 6s., and you have £47 6s. saved per 100 lamps per year.

Of course there is the cost of the apparatus to be considered, but, as they may be obtained for about 6s. or 7s. each, and the estimated cost of keeping them in repair is about 3d. each per annum, the interest upon the outlay and the cost of maintenance would be but small.

3. Experience has proved that breakage of the lamps is very much less.

I am aware that objection may be taken to the introduction of this invention in hilly districts, but, as it is desirable that the pressure over the whole district should be uniform, whether this or any other method be adopted, and as apparatus such as that invented by Mr. Cathels has been devised to meet such circumstances, I cannot conceive but that this system may be used, however unlevel the area lighted may be.

When you can stand on some elevated spot commanding a view of a considerable number of lamps, it is an interesting sight to see them light up almost simultaneously without any visible agency.

Having briefly stated these few particulars in reference to Mr. Price's Patent Lamplighter, I beg now to leave them to your consideration, and shall be happy to learn that the invention meets with the favour I think it deserves.

In conclusion, I think you will agree with Mr. Barlow that it is an ingenious contrivance, reflecting credit on its inventor, and not unworthy of the notice of the members of this association.

Mr. HUNTER (Louth) thought the invention was a very pretty one, and the theory extremely good, but doubted the practicability of its adoption. In the town he represented the public lamps only burnt 1800 hours in the season, and it would be impossible to regulate them in this way, because they were not lighted at a uniform time. Mr. Eldridge had put the lighting and cleaning of lamps at 12s. per annum each. In Louth, the lighting, cleaning, and extinguishing were done at 5s. per lamp, so that the saving by this method, if practicable, would not be so great as calculated.

Mr. COPLAND admitted the ingenuity of the plan, but thought the difficulty of maintaining the subsidiary light would be very great. If there should happen to be any oscillation at the governor upon the works, the public lamps would not be lighted.

Mr. ANDREWS said he had ordered half a dozen of the apparatus for trial. He had not fully tried them at present, but he had found out the inconvenience mentioned by Mr. Copland as to the liability of the subsidiary light to extinction. He had turned his attention to the question of the saving said to be effected. It was supposed that the subsidiary light would burn 3 feet of gas in the 24 hours. He found that with a pressure of 12/10ths on the experimental gasholder the consumption was 4⅛ cubic feet per hour for three lamps, making an average of more than 1 foot per hour each. Great inconvenience might arise from the subsidiary burner being always alight, as sometimes gas companies were obliged to put on a higher pressure during the day, when representations were given in towns, and it would be extremely awkward in these cases to have all the public lamps lighted up. Occasionally, too, it became necessary to increase the day pressure for the purpose of testing new mains, and here, again, the inconvenience would be felt. He also found that by this plan the lamps did not light simultaneously—*i. e.*, not instantaneously. It required a considerable amount of pressure, and a decided impetus to be given, before the flame shone out to its full size. Of course, gas managers did not put on the pressure of an evening all at once, experience teaching that the more gradually it was done the better in every way. Under all the circumstances, he did not believe that in a town with, say, 1000 lamps, the plan would be practicable, though it might do very well on gas-works, or for the lamps of a private individual. At Swansea, the highest point of lighting was 330 feet above the works; the pressure therefore varied considerably, and though he had governors and valves it was not so much under control as he could desire. With a varying pressure, great difficulty would be found in carrying out the plan.

Mr. CRAVEN (Dewsbury) said in the town which he represented the company lighted the lamps belonging to two corporations and three separate local boards, and in nearly every instance they had a separate scale for lighting. In one case they lighted for 3000 hours, in another 2000 hours a year, and it would be extremely inconvenient when the pressure was put on to be giving the same amount of light to both.

Mr. BROADHEAD (Grimsby) thought it would require one man at least to be constantly going round the town to see that the subsidiary burner was alight. Every gale of wind, especially if there were any broken glasses, would imperil the regularity of the service.

Mr. DUNNING said, if not universally applicable, there were many places in all large towns in which the arrangement would be a positive advantage. Take, for instance, a theatre, where it was required in some very simple way to lower the lights at times all at once. If the place were fitted up with lights on this principle, such an operation could be performed with more regularity.

Mr. FRASER thought the plan could be made applicable to public lamps if there were a subsidiary main governed by a special governor.

Mr. CATHELS said it was hardly fair to attack an invention because it was not applicable to some particular case. The one now before the association

was one which he was working out in his own mind when he found that Mr. Price had taken out a patent for it. His only objection to Mr. Price's small jet was, that the consumption of gas by it was very great. It could not be kept in under a consumption of half a foot an hour.

Mr. PRICE said he had 150 of these lamps now in action, and they were perfectly successful. Of course, wherever the plan was carried out the lamps must be adapted accordingly. In lamps, with the present system of ventilation, the small flame would be liable to be extinguished. As to the objection on the score of the pressure required to light the principal burners, of course it would depend upon how the valve was weighted as to the number of tenths required. It was possible to light them with one-tenth.

Mr. WARNER was disposed very thankfully to receive Mr. Price's communication as a fair contribution to the settlement of a very important subject which deserved much attention. He had no doubt the invention could be made very serviceable in its adaptation to private purposes, as in exhibitions, &c., where the lowering and raising of the lights with facility was a desideratum.

Mr. METHVEN asked whether a regulator could be applied in addition; if not, all the advantages the invention offered would be lost.

Mr. PRICE said it could be very readily adopted, and would be screwed on to the end of the tube. He had about 60 in use with regulators.

Mr. ELDRIDGE said the variation in the hours of lighting referred to by one of the speakers was not a usual thing, and, of course, in such cases the invention could not be applied. He thought the estimate of 5*s.* per lamp per annum for lighting, cleaning, and extinguishing was in an extremely exceptional case, and that 12*s.* per lamp might be taken as a fair average. With regard to the little jet, it might be made to consume any quantity of gas desired by an adjustment of the screw.

The PRESIDENT said on two or three occasions Mr. G. Livesey had favoured the association with a paper on his mode of liquor purification of gas. The experiments had not succeeded as at first anticipated, and Mr. Livesey fully intended to be present on this occasion, and to lay before the members the cause of the failure. In his unavoidable absence he had forwarded a paper on the subject, which would now be read.

The HON. SECRETARY read the following paper by Mr. Livesey:—

THE PURIFICATION OF GAS WITH AMMONIACAL LIQUOR.

I fear the association must be tired of this subject; but as, on two previous occasions, I have read papers giving details of experiments which appeared to promise success, I feel it to be right to give the cause of failure. This would have been done at the last meeting, for I had arranged with a member of the committee that he should put the question to me at the meeting; but, owing to the discussion on one of the papers being carried on with so much spirit, he did not have the opportunity, and so it remains to be done now.

The cause of failure may be very easily explained, and in few words; but, in order to make it clear, it is necessary to give a short statement of the theory and principles of the system of liquor purification.

It being well known that caustic ammonia has a strong affinity for sulphuretted hydrogen, and having discovered that carbonate of ammonia has a like affinity, it follows that ordinary ammoniacal liquor deprived of its sulphuretted hydrogen is capable of absorbing that impurity.

The desulphuration of the crude liquor was effected by bringing it into contact, in an ordinary scrubber filled with coke, with the waste gases from the combustion of coke in the retort furnaces, the result being that the carbonic acid completely displaced the sulphuretted hydrogen which was combined with the ammonia in the liquor; but at the same time a small proportion of the ammonia itself was carried away, and though this was not lost, still it could not be returned to the liquor to be used in purifying the gas, and herein lies the cause of failure—the extreme volatility of ammonia in my case, as in Laming's, leading to that result.

When my last paper was read I had just got the process in full work, and starting with about 8 oz. liquor, it very successfully purified the gas; but as each time of desulphurating deprived the liquor of a small portion of its ammonia, the liquor slowly got weaker, until by the winter of 1867 it was reduced to only 4 oz. strength, and this was too weak to purify the gas, besides being worthless for sale; hence the failure was complete both practically and commercially.

In conclusion, I may say that it would have afforded me (had circumstances permitted it) much pleasure to have met my friends face to face, and to have made this statement personally; but I have the satisfaction of knowing that neither any of my professional brethren nor their companies have been involved in trouble or expense in trying that which would have failed to realize what was at one time expected of it.

The meeting then adjourned.

(*To be continued.*)

THE GAS QUESTION AT BILSTON.

[From the *Birmingham Daily Post.*]

An Adjourned Meeting, with a view to obtain a good and cheap supply of gas to Bilston, was held in the Temperance Hall, in that town, on Thursday evening. The meeting was called by requisition to the chairman of commissioners, who is also the chairman of the existing Bilston Gas Company. That gentleman was present at the first meeting, which was adjourned, but declined to take the chair, because he might have to reply to statements made by the speakers, and upon his suggestion Mr. Dean became the chairman. Mr. Dean presided again on Thursday night, and, after Mr. Purcell had said that it was a slight upon the town that Mr. Hatton (chairman of the commissioners) was not present that night, the CHAIRMAN moved the first resolution. He said that the price now charged was excessively high and exorbitant. It was 50 per cent. higher than that paid by some of the neighbouring towns, and even 100 per cent. more than some. In Bilston they had to pay 4*s.* per 1000 cubic feet, and 1*s.* for the meter. He, however, held in his hand a receipt of the Birmingham and Staffordshire Company, who charged 2*s.* 7½*d.* per 1000. In addition, the gas was of a bad quality. He moved—"That, in the opinion of this meeting, the price of gas charged to the consumers by the Bilston Gas Company is excessive, and that the township of Bilston ought to be supplied with gas of as good and cheap quality and price as the neighbouring towns, Walsall, Wednesbury, Darlaston, and Wolverhampton."

Mr. SALE seconded the motion. He inquired why it was that there was so large a difference as 1*s.* per 1000 feet in the price of gas in Bilston. Some consumers had to pay 4*s.* per 1000, while he himself obtained it at 3*s.* per 1000, but had to burn 50,000 cubic feet. He believed that the 1*s.* was taken off for the purpose of stopping the mouths of the customers, so that they should not complain of the exorbitant prices.

Mr. EDRIDGE supported it. They all agreed that the price was exorbitant, and they came there to know why the present company could not supply the town with gas as cheap as other companies supplied other places. He thought that the Bilston Company were in an equal position, as regards the breakages and crownings-in, with neighbouring companies. The great mistake of the Bilston Company had been going out of the town. They wanted to be bigger men than they ought to be. They had gone round Coseley, Fullwood's End, and almost to Prince's End, instead of stopping in the town. If they had confined themselves to the town they would have made 10 per cent., and the interest on the capital laid out beyond the town would not be going out of the pockets of the Bilston inhabitants.

Mr. PURCELL said it was a notorious fact that in Moxley one man paid 2*s.* 9*d.* for his gas, while his next-door neighbour, supplied by another company, was paying 4*s.* With the high prices the Bilston Company had always received, they ought to charge less for the gas than the present price. He was afraid that the leakage was into the pockets of the company, and not from the mains.

Mr. HEDLEY, consulting gas engineer, of Wolverhampton, said that he appeared there altogether independent of any one in the town or district, and had attended the meeting to show what gas was being sold at in the neighbouring towns, and what it could be made and sold at in Bilston. After showing that he had been connected with gas-making for 33 years, he said that the result of his calculations was as follows:—Taking the make of gas at 88 million cubic feet, and the sale of gas at 76 million cubic feet, the cost of coal at an average of 10*s.* per ton, and to bring the quality of gas up to an illuminating power equal to 14 sperm candles (and it ought not to be sold at a poorer quality), taking the sale of coke at 6*s.* per ton, he found that gas could be delivered into the consumers meters at a cost of 1*s.* 7*d.* per 1000 feet. If they had a capital of £30,000 to supply Willenhall and Bilston they would want 1*s.* per 1000 cubic feet to pay a dividend of 10 per cent., so that they would want 2*s.* 7*d.* back from the consumers. In Birmingham the gas could be sold at 2*s.* 2*d.* per 1000, but for the monopolies in that town. Last year the Bilston Company, notwithstanding that they had a reserve-fund and a works restoration fund, charged the cost of making alterations in their works, by which they could now be managed without a manager, to the profit and loss account, and but for that their profits would have enabled them to pay a dividend of almost 9 per cent. The town of Hanley was in a much similar position to that of Bilston; but, under his superintendence, a competing company was started, and the House of Lords decided that the company must reduce the price of gas, insert clauses which enabled the town of Hanley to have their gas tested whenever they liked, compelled the company to supply it of a certain quality, and, in addition, imposed all the costs of the agitation upon the company.

The CHAIRMAN put the resolution, which was carried without a dissentient, amidst much cheering.

Mr. W. M. HANCOX, surgeon, said he thought there was no prospect of getting cheap gas from the present company. There was, however, a probability of obtaining such a commodity from a new company, and he therefore moved a resolution to the effect that the meeting pledges itself to do all in its power to promote the Bilston and Willenhall Gas Consumers Company.

Mr. JONES, publican, High Street, seconded the motion.

Mr. KEAY moved an amendment, to the effect that the meeting should appoint a deputation to wait upon the present company, and endeavour to get them to reduce the price of gas to the point Mr. Hedley had named. That, he thought, was the most certain way of getting cheap gas, for it was by no means certain that they would get cheaper gas if a rival company was established in the town. If the course he proposed did not succeed, then they might consider either the buying of the works or the establishing of the new company.

Mr. S. KEMP seconded the amendment.

Mr. EDRIDGE supported it, after warning the meeting of the great responsibility they were taking by pledging themselves to support the new company.

Mr. CREMONINI approved of the amendment.

Mr. HEDLEY urged the meeting to support the new company. If they did so, the present company could still come to terms.

Mr. REEVES, clerk to the company, said that it was not likely that the directors would attend the meeting after the display of feeling and the insults their chairman was subject to from "a tinkering man of the town" at the last meeting.

This remark quite disturbed the meeting, and there were for some time loud cries of "Turn him out," "Sit down," and much disorder.

The "TINKERING MAN OF THE TOWN" explained that when he insulted the chairman of the directors, that gentleman was insulting the ratepayers by misconducting the meeting.

Mr. STALLARD supported the resolution.

Mr. CARELESS said the company ought to be made to supply gas of a certain quality.

On a division, two persons only voted for the original resolution, and the amendment was therefore carried by a large majority.

A committee, consisting of the chairman, and Messrs. Purcell, Edridge, Hancox, Sale, Williams, and Keay, was appointed to meet the company, and the meeting was adjourned for a fortnight, when the deputation will report the result of their interview.

The chairman was thanked, and the meeting separated.

THE GAS SUPPLY OF THE CITY OF LONDON.—Dr. Letheby, the chief gas examiner, appointed by the Board of Trade, has reported on the quality of the gas supplied to the City during the months of April, May, and June; and it appears that, when tested in accordance with the provisions of the Statute, the maximum, minimum, and average illuminating power of the gas of the three City companies has been as follows:—

Illuminating Power in Standard Sperm Candles.

	Max.	Max.	Average.
City of London Gaslight Company .	15·73 ..	14·10 ..	14·87
Chartered Company	15·90 ..	14·10 ..	14·98
Great Central Company	15·62 ..	14·06 ..	14·72

And, with respect to the purity of the gas, he reports that ammonia has been constantly present in the Chartered and Great Central gas, but that the gas of all the companies has been quite free from sulphuretted hydrogen. The proportions of sulphur in the gas have been as follows:—

Grains of Sulphur per 100 *Cubic Feet of Gas.*

	Max.	Min.	Average.
City of London Gaslight Company .	23·40 ..	7·02 ..	17·00
Chartered Company	21·45 ..	10·75 ..	16·86
Great Central Company	26·72 ..	4·16 ..	11·58

These results indicate a remarkable range in the proportions of sulphur, the minimum proportions being altogether unusual.

LUTON WATER-WORKS.—Mr. T. F. Middlemiss, who, in April last, resigned the surveyorship of Cockermouth, was, on the 18th of June, appointed engineer, manager, and secretary to this company, *vice* Mr. W. Wood, Gas-Works, Cambridge. The works are now being constructed, and are expected to be completed in a few months.

PRESENTATION TO MR. T. R. MELLOR.—The European assistants and foremen in the employ of the Oriental Gas Company, at Calcutta and Howrah, lately determined to show their appreciation of the kindly feeling which had at all times subsisted between themselves and the manager of the company, by presenting him with a token of their esteem on the occasion of his retiring from his appointment and returning to England, after occupying the position of engineer and manager for over seven years. The testimonial was in the form of a handsome and most elaborate drawing-room timepiece, on which was the following inscription:—"Presented to T. Randolph Mellor, Esq., C.E., by the European assistants and foremen in the employ of the Oriental Gas Company, as a mark of their esteem, on the occasion of his retirement from the office of chief engineer and manager, April, 1869." The presentation was made at a farewell dinner given to Mr. Mellor, at the residence of Mr. J. Blackburn, the successor of Mr. Mellor as engineer and manager of the company's affairs in India. The duty of making the presentation was entrusted to Mr. E. Blanchett, the senior assistant manager, who directed attention specially to the great improvement in the position and prospects of the company during Mr. Mellor's management. The presentation was suitably acknowledged by Mr. Mellor, who expressed the pleasure it afforded him to have the opportunity of acknowledging the valuable assistance which he had at all times received from the whole of the company's European *employés*.

BE CAREFUL AS TO WHOM YOU PAY YOUR GAS BILL.—At the Surrey Sessions, before Sir Thomas Tilson, on Wednesday, Charles Withyman, 32, labourer, was charged with stealing a bank-note for £5, the property of Charles Young. The prisoner, who is a lamplighter in the service of the Crystal Palace Gas Company, was delivering accounts on the 9th of April. He delivered one of these at the shop of the prosecutor at Norwood, when Mrs. Young handed him a £5 note to take payment out of it. He went out to get change, but was heard nothing more of, either by the prosecutor or his employers, until he was taken into custody. The defence was that the prisoner went to several places seeking for change, and there was no doubt about this being true. He then put his hand into his pocket, found the note was gone, and so he absconded. Mr. Ohren, secretary of the Crystal Palace Gas Company, gave the prisoner a good character, and said that their customers were all warned against paying money to any one but the authorized collector. The jury returned a verdict of "Not guilty," and prisoner was discharged.—*Sydenham Times.*

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

1872.—JOHN GARRETT TONGUE, of the firm of Tongue and Birkbeck, of 34, Southampton Buildings, Chancery Lane, in the co. of Middlesex, patent agents and engineers, for "*The production of novel and ornamental effects in the manufacture of various articles of glass applicable to various ornamental and other objects, and to lamp-shades, globes, reflectors, or other transparent or semi-transparent articles made of glass, and in means or apparatus employed for the above purpose.*" A communication. June 18, 1869.

1922.—HENRY ALEXANDER FREDERICK DUCKHAM, of Camden Town, in the co. of Middlesex, gas engineer, for "*Improvements in gas-regulators.*" June 23, 1869.

1931.—ALFRED HENRY STILL and DENNY LANE, both of the city of Cork, for "*Improvements in the manufacture of gas.*" June 24, 1869.

1973.—ROBERT HEYWORTH, of the city of Manchester, in the co. of Lancaster, plumber, for "*Improvements in water-closets, wash-basins, and urinals, and in self-acting apparatus for the same.*" June 30, 1869.

1979.—RICHARD WAINWRIGHT WHITEHEAD, of Ashton-on-Mersey, in the co. of Chester, for "*Improvements in coupling or jointing pipes or tubes.*" July 1, 1869.

GRANTS OF PROVISIONAL PROTECTION.

1697.—JOHN FLETCHER, of Ashton-under-Lyne, in the co. of Lancaster, brassfounder and finisher, for "*An improvement in steam and other cocks applicable to union joints, which I call 'union cocks.'*" June 2, 1869. April 7, 1869.

1810.—JOSEPH HADLEY RIDDELL, of Cheapside, in the City of London, for "*Improvements in joints or connexions for uniting and securing together the ends of pipes or tubes.*" June 12, 1869.

1816.—EDWARD GRIFFITH BREWER, of 89, Chancery Lane, in the co. of Middlesex, patent agent, for "*Improvements in connecting pipes or tubes.*" A communication. June 14, 1869.

1818.—JOHN TAYLOR, of 27, Russell Street, Bermondsey Street, S.E., engineer, for "*A floating and sliding top for wells, tanks, cisterns, or any other kind of vessel for keeping or holding water, fermented or unfermented, or any other kind of liquor.*" June 14, 1869.

1858.—BRISTOW HUNT, of 1, Serle Street, Lincoln's Inn, in the co. of Middlesex, gentleman, for "*An improved apparatus for ventilating and purifying rooms or apartments.*" A communication. June 16, 1869.

1922.—HENRY ALEXANDER FREDERICK DUCKHAM, of Camden Town, in the co. of Middlesex, gas engineer, for "*Improvements in gas-regulators.*" June 23, 1869.

NOTICES TO PROCEED.

416.—JOHN FLOWERS BENTLEY, of Peterborough, in the co. of Northampton, for "*Improvements in filters.*" Feb. 10, 1869.

432.—BENJAMIN PRYOR STOCKMAN, of 23, Abingdon Street, Westminster, in the co. of Middlesex, civil engineer, for "*Improvements in meters applicable to measuring water.*" Feb. 11, 1869.

506.—FREDERIC DELBREIL, of Versailles, France, for "*Improvements in apparatus for removing and facilitating the utilization of excrementitious or other refuse matter which passes into the sewers, or is deposited in cesspools or elsewhere in cities, towns, and other localities.*" Feb. 18, 1869.

508.—WILLIAM MARSHALL COCHRANE, of Surbiton, in the co. of Surrey, gentleman, for "*Improvements in vessels for containing water and other liquids, and in means for suspending and carrying the same.*" Feb. 19, 1869.

528.—ARTHUR JACOB, of Bromley, in Kent, civil engineer, for "*Improvements in the ventilation of sewers.*" Feb. 20, 1869.

535.—FRANCIS GEORGE FLEURY, of 24, Merrick Square, Southwark, in the co. of Surrey, engineer, for "*Improvements in meters or apparatus for measuring water and other liquids.*" Feb. 20, 1869.

728.—THEOBALD OBACH, of Manchester, in the co. of Lancaster, engineer, for "*Improvements in fuel economizers, parts of which are applicable to joining and fixing pipes for other purposes.*" March 9, 1869.

730.—WILLIAM ROBERT LAKE, of 8, Southampton Buildings, Chancery Lane, in the co. of Middlesex, consulting engineer, for "*Improvements in devices for rendering gas-burners self-lighting.*" A communication. March 10, 1869.

914.—CHARLES MARSDEN, of Kingsland Road, in the co. of Middlesex, for "*Improved means of and apparatus for making gas and water tight flexible joints to pipes and tubes.*" March 25, 1869.

1077.—WILLIAM ANTHONY HUNTER, of Southport, in the co. of Lancaster, for "*Improvements in apparatus for lighting street and other lamps.*" April 9, 1869.

1572.—WILLIAM HENRY DUPRE, of Jersey, for "*Improved apparatus for giving light and ventilation to rooms, houses, or other buildings.*" May 21, 1869.

1715.—JOHN LLOYD, engineer to the Lilleshall Iron Company, near Shifnal, in the co. of Salop, for "*Improvements in the construction of fans for ventilating.*" June 3, 1869.

Advertisements.

C. A. S. VICKARY,

(ADMINISTRATRIX TO THE LATE JOHN VICKARY,)

GAS ENGINEER AND CONTRACTOR, IRON AND BRASS FOUNDER,

EXE ISLAND, EXETER,

Tenders her best thanks to the various Gas Companies in **England, Ireland, and Wales,** for the very liberal and kind support received by her lamented husband for the last **22 years,** during which period he erected and extended more than **200 Gas-Works.** She respectfully solicits a continuation of that support, and begs reference to the following testimonial:—

Plymouth and Stonehouse Gaslight Company.

Sir,—I have much pleasure in testifying that the 100-foot Telescope Gasholder and Cast-Iron Tank, erected by you for this Company in 1862, has given the highest satisfaction, and never required the slightest alteration or adjustment since its completion.

Mr. John Vickary. (Signed) PETER ADAMS, Chairman.

The late Mr. Vickary also erected a 100-foot Gasholder and Cast-Iron Tank at **Exeter;** an 80-foot Telescope Gasholder and Iron Tank at **Devonport;** a 90-foot at **Torquay,** &c., &c. At either of these works satisfactory references can be made.

C. A. S. V. begs particular attention to her **Improved Gas-Meters,** both **Wet and Dry,** the materials and workmanship of which are guaranteed of the very best description, and which have gained for her Meters so excellent a reputation.

RETORTS, DIP & ASCENSION PIPES, HYDRAULIC MAIN, CONDENSERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, and GASHOLDERS,

Of any size, and every description of article required in Gas-Works supplied.

Mains, Tees, Connexions, and Syphons, from 2 to 12 in., always in stock, and supplied at Scotch prices.

Clay Retorts and Fire-Goods of every description.

Chandeliers and Gas-Fittings of the most modern designs.

Iron Pipe and Fittings, Service Cocks, &c.

Plans, Specifications, and Estimates for the Erection of New Gas-Works of any size furnished.

TO GAS COMPANIES.

WANTED, by a steady young Man, a situation as MANAGER for a gas-work. Good fitter in all its branches. Retort setter with the assistance of bricklayer. Good references.

Apply by letter, stating salary, to F. BARNEY, Gas-Works, WATLINGTON.

DUNGANNON GAS COMPANY.

WANTED, a Manager for these works. Salary £100 per annum, with a free house, coal, and light. None but competent men need apply, whose character will bear the strictest investigation, particularly as to ability, sobriety, and integrity.

Applications, enclosing copies of testimonials, to be addressed to the SECRETARY, Dungannon Gas Company, Dungannon, county TYRONE.

Board-Room, Dungannon, June 14, 1869.

WANTED, by a young Man, aged 24, a situation as Book-keeper, Collector, or Traveller. Seven years with a gas company. Good character and security.

Address R. HODGETTS, 30, St. Paul's Street, NEW NORTH ROAD, N.

WANTED, by a thoroughly practical Man, a situation as WORKING MANAGER of a small gas-work, at home or abroad. Several years experience. First-rate testimonials.

Address GASOMETER, No. 1a, Pembroke Terrace, Earl Street, KENSINGTON, W.

WANTED, by the Advertiser, a situation as SECRETARY and MANAGER of a gas-work producing about 10,000,000 per annum. Highest respectability and character.

Address Z., Post-Office, New Barnet, LONDON.

WANTED, by the Sunderland Gas Company, a METER INSPECTOR.

Applications, stating age, present employment, qualifications, and salary required, to be sent to J. H. Cox, Secretary and Manager.

TO GAS & HYDRAULIC ENGINEERS.

A Young Man, accustomed to the business of a large engineering works, a smart draughtsman, has received a first-class technical education, and can give the highest testimonials, is desirous of an ENGAGEMENT with the above.

Address BETA, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS COMPANIES & OTHERS.

THE Secretary and Manager to a provincial gas company, where the number of consumers is upwards of 3000, will be disengaged at the end of August, and would be glad to offer his services to a gas company, where the annual make of gas is from 30 to 50 million cubic feet. Thoroughly and practically understands the manufacture and distribution of gas upon the best principles, also the varied routine of office work, having had upwards of 10 years experience in the general management of gas-works, and who has during the last 7 years held the position of secretary and manager.

The most satisfactory references and testimonials can be furnished as to ability and public and private character, and security given to the required amount. Aged 31, married.

Address GAS MANAGER, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GASHOLDER FOR SALE.

THE Keighley Local Board of Health have FOR SALE a second-hand GASHOLDER, 40 ft. diameter and 14 ft. deep, with pillars, &c., complete. The Gasholder is in good condition, and is being sold to make room for alterations in the works.

Further particulars can be obtained on application to the undersigned, at the Gas-Works Offices, Low Bridge, KEIGHLEY.

June 19, 1869. JOHN LAYCOCK, Superintendent.

EDGE'S Patent for Removing the CARBONACEOUS INCRUSTATION from GAS-RETORTS.

For particulars and terms, apply to E. GODDARD, Sole Agent, Gas-Works, IPSWICH.

WANTED, an active intelligent Man as TURNCOCK for the Newark Water-Works Company. He must be able to lay water-mains, attach services, do plumbers work, and thoroughly understand the management of water-works.

Apply, stating age, wages required, with other particulars, to Mr. NEWTON, Secretary, Water-Works Company, NEWARK.

IN CONSEQUENCE OF THE ENLARGEMENT OF THE WORKS,

THE Directors of the High Wycombe Gas Company have FOR SALE a set of Three cast-iron dry-lime Purifiers, 6 ft. by 5 ft. 9 in. by 2 ft. 10 in., with 6-in. connexions, &c.; 6-in. Governor, with connexions; Two Gasholders, each capable of containing 8400 cubic feet of gas; 12-in. Hydraulic Main and Ascension-Pipes; cast-iron Frames, Mouthpieces, &c., for Cliff's Ovens; and a small Scrubber.

For further particulars apply to Mr. W. A. PADFIELD, Manager and Secretary, Gas-Works, HIGH WYCOMBE.

PETERBOROUGH GAS COMPANY.

SURPLUS Plant for Sale.—Four 6-ft. square cast-iron Purifiers; Four 7-ft. square wrought-iron Purifiers; wrought-iron Sieves and Covers, and Lifting Apparatus complete; and 7-in. and 8-in. Connexions, with centre-valve. Also Four lengths 16-in. round Hydraulic Main, 11 H-Pipes, Six 18-in. Mouthpieces, Lids, and Screws; also several Valves.

For further particulars, apply to E. EVANS, Manager, at the Office, LONG CAUSEWAY.

June 16, 1869.

TO GAS ENGINEERS & CONTRACTORS.

THE Directors of the Chipping Camp- den Gas and Coke Company, Limited, invite TENDERS for the construction of their WORKS, according to plans and specifications which will be open for inspection (on the payment of a fee of 10s. 6d.) at the offices of the Company, Chipping Campden, from and after the 5th of July next.

Sealed Tenders to be sent in free, addressed to the "Directors of the Chipping Campden Gas and Coke Company, Limited," on or before the 19th of July next.

The person whose tender may be accepted will be required to enter into a bond with two responsible sureties for the due performance of the contract to the satisfaction of the Company's Engineer.

The Directors do not bind themselves to accept the lowest or any tender.

Gas Company's Office, Chipping Campden,
June 21, 1869.

BREEZE FOR SALE.

THE Directors of the Crystal Palace District Gas Company are desirous of receiving TENDERS for 1200 chaldrons of BREEZE, being about the quantity produced at these works between the 23rd inst. and the 30th of June, 1870. If sent by rail, a branch runs from the South-Eastern Railway Company's line into this Company's works, and trucks can be despatched from the works to any goods siding along that company's line; also, *viâ* Bricklayers Arms Station, to any part of the London, Brighton, and South Coast Railway Company's line; and, *viâ* Beckenham, on to the London, Chatham, and Dover Railway Company's line.

Tenders to be addressed to the Chairman of the Company, marked "Tender for Breeze," and sent to the Company's Offices not later than Thursday, the 22nd inst.—By order of the Board,

MAGNUS OHREN, Secretary.

Offices of the Company, at the Works,
Lower Sydenham, S.E., July 3, 1869.

GAS TAR & AMMONIACAL LIQUOR FOR SALE.

THE Directors of the Dudley Gas Company invite TENDERS for the surplus TAR and AMMONIACAL LIQUOR to be produced at their works for one year, ending June 30, 1870. The quantity of Tar will be about 60,000 gallons, and Liquor 150,000 gallons.

Tenders to be sent in not later than the 13th of July next.

The Directors do not bind themselves to accept the highest or any tender.

Gas-Works, Dudley, June 23, 1869.

SUTTON-IN-ASHFIELD GAS COMPANY.

SURPLUS PLANT.

THE Directors of the Sutton-in-Ash- field Gas Company have FOR SALE a set of Two cast-iron dry-lime Purifiers, 5 ft. 6 in. by 5 ft. by 2 ft. 6 in.; cast-iron Centre-Valve to work either two or three purifiers, with 6-in. connexions; cast-iron Tank, under centre-valve; all complete and in good condition. Also one length D-shaped Hydraulic Main, 9 ft. 11 in., pierced for five dip-pipes; one other length, 9 ft. 8 in., for three dip-pipes and outlet; eight H-pipes for the above; 10 large Mouthpieces for D clay retorts, 20½ in. by 14½ in.; 16 Mouthpieces, 15 in. by 13 in.; all with lids and cotters complete. The above are all inside measurement.

For price and further particulars, apply to Mr. C. PLUMBE, Secretary, Sutton-in-Ashfield, Mansfield, NOTTS.

HENRY F. WILLEY,

GAS ENGINEERING WORKS,

BARTHOLOMEW STREET, EXETER,

MANUFACTURER OF EVERY DESCRIPTION OF GAS APPARATUS,

Invites particular attention to his

GAS-METER DEPARTMENT,

Where he manufactures both WET and DRY METERS, several hundred of which are in use in many Gas-Works in England, Ireland, and Wales.

These Meters have received the highest praise from many eminent Gas Engineers, for their excellence of manufacture, superiority of workmanship, and accuracy of register. They are warranted to measure correctly and not to vary. Every Meter manufactured by him maintained in perfect repair for a period of *five years*. All bear the Government stamp.

GAS-FITTING DEPARTMENT.

A variety of very beautiful and choice patterns and designs adapted for any character of buildings, including MEDIÆVAL FITTINGS for CHURCHES, &c.; Handsome STAR PENDANTS for ASSEMBLY ROOMS, &c.; CHANDELIERS, PENDANTS, BRACKETS, &c.

ENGINEERING DEPARTMENT.

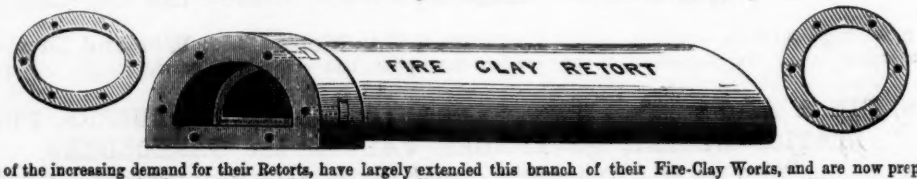
Every description of GAS APPARATUS, comprising GASHOLDERS, STATION-METERS, GOVERNORS, CONDENSERS, PURIFIERS, RETORTS, SLIDE-VALVES, and every article appertaining to Gas-Works.

Gas Companies advised on Improvements, Extensions, and Alteration of Works.

*** The very best material and workmanship guaranteed, and at prices bearing a favourable comparison with any House in the Kingdom.

THE FARNLEY IRON COMPANY,

FARNLEY, near LEEDS,



In consequence of the increasing demand for their Retorts, have largely extended this branch of their Fire-Clay Works, and are now prepared to execute the most important orders, either for *home* or *export*, with great punctuality.

The Fire-Clay raised from the Farnley Estate (commonly called the Wortley bed) is unsurpassed by any other known in the district, and is peculiarly well adapted for Retorts, Gas-Ovens, and Fire-Bricks; and the F. I. Co. beg especially to invite those connected with Gas-Works, who have not yet used their Retorts, to be good enough to favour them with a trial.

The F. I. Co. generally hold in stock, for immediate supply, Fire-Bricks of every size and kind—Tiles, Sanitary Tubes, Ornamental Terra-Cotta Ware White Facing Bricks, the White, Buff and Salt-Glazed Bricks, &c., &c.

Prices, Drawings, and all other information may be obtained by applying as above, or to

MR. SUTTON, THE HULL STORES, 46½, QUEEN STREET, HULL.

INTERNATIONAL EXHIBITION,
1862. CLASS X.
PRIZE MEDAL
For excellence of Fire-Clay Gas Retorts, and
"HONOURABLE MENTION" for
good quality of Fire-Bricks.

WILLIAM STEPHENSON & SONS,
THROCKLEY,
NEWCASTLE-ON-TYNE.

JAMES NEWTON & SONS,
(Established 1820,)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
SOUTHWARK, LONDON, S.E.,
DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for
GAS AND WATER WORKS.

HANCOCK'S INDIA-RUBBER GAS-TUBING.
All sizes, from ⅛ in. to 4 in. diameter and upwards.
Also,
HORSE SINGEING APPARATUS, best make, with GAS-BURNERS, COMBS, and INDIA-RUBBER TUBING, all complete.
INDIA-RUBBER BAGS for GAS-MAINS.
WASHERS for GAS and STEAM JOINTS.
VALVES (pure solid Rubber) for STEAM-ENGINES.
PACKING (Elastic) for STEAM-ENGINES.
FLANGE TUBING, for excluding Draughts and Dust through WINDOWS, DOORS, and GLASS CASES.

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Illustrated Price Lists on application.
JAMES LYNE HANCOCK,
Vulcanized India-Rubber Works,
GOSWELL MEWS, AND 266, GOSWELL ROAD
LONDON, E.C.

Established 1811.
READY & SON,
BILSTON STREET BRASS FOUNDRY,
WOLVERHAMPTON,
MANUFACTURERS OF
SUN BURNERS, GAS CHANDELIERS,
HALL LANTERNS, BRACKETS, PENDANTS,
And every Description of
GAS-FITTINGS,
Including
MEDIÆVAL FITTINGS for CHURCHES, &c.
Large Pattern Books complete, with Book of Prices, 7s. 6d.

STOURBRIDGE FIRE-CLAY WORKS.
E. BAKER & CO.,
24 WHARF, HARROW ROAD, PADDINGTON, W.
FIRE-BRICKS, LUMPS, SQUARES, and TILES of all dimensions.
GAS-RETORTS always in stock.
GARDEN EDGINGS of various patterns.
ORNAMENTAL BUILDING BRICKS.
GRATE BACKS in various designs.
Contracts entered into to set Retorts, erect Furnaces, &c.
Shipments on the shortest notice.
Makers of A. C. FRASER'S Patent Ribbed Retorts and Brick Ovens.

HOPKINS, GILKES, & CO.,
LIMITED,
MIDDLESBOROUGH,
SUPPLY GAS AND WATER PIPES OF EVERY SIZE,
Plain, Turned and Bored, and Coated.
CAST-IRON RETORTS.
Castings for Gas-Works of every description.
EXHAUSTERS.
LONDON OFFICE: 95, CANNON STREET.

TO INVENTORS AND PATENTEES.
MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.
Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.
Patents procured for Foreign Countries.
Information as to cost, &c., supplied gratuitously upon application to the advertiser, 42, Parliament Street, WESTMINSTER. [Office of the JOURNAL OF GAS LIGHTING, &c.]

Trade Mark. **THE MEDAL FOR 1862.**
THE ONLY PRIZE MEDAL AWARDED FOR TUBES AND FITTINGS.
CROWN TUBE-WORKS,
WEDNESBURY STAFFORDSHIRE.
WAREHOUSE—81, UPPER GROUND ST., LONDON.
JAMES RUSSELL & SONS,
Patentees and First Makers of Wrought-Iron Tubes.

TO GAS COMPANIES AND THE TRADE.
J. DEFRIES & SONS,
MANUFACTURERS OF
CRYSTAL, BRONZED, & ORMOLU
CHANDELIERS;
IMPROVED CRYSTAL STAR & SUN LIGHTS;
VESTIBULES,
IRON BARREL, COMPOSITION TUBING,
AND
GAS-FITTINGS OF EVERY DESCRIPTION.
WORKS:
LONDON, BIRMINGHAM, AND PARIS.

REGISTERED CRYSTAL CHANDELIER.
Special Designs prepared in perfect accordance with architectural arrangements. Estimates furnished for the Lighting and Fitting up of Theatres, Music-Halls, and Public or Private Buildings with Gas.
GAS MOONS OF THE NEWEST DESIGNS.
The Patent Gas-Regulator & Purifier reduced to 6s. 6d. per Dozen.
Pattern Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1869, are now complete.
CITY SHOW-ROOMS & MANUFACTORY,
147, HOUNDSDITCH.

J. T. B. PORTER & CO.,
GAS ENGINEERS,
MANUFACTURERS AND CONTRACTORS FOR GAS-WORKS
Of any extent at Home and Abroad,
GOWTS BRIDGE WORKS, LINCOLN,
AND
JOHN STREET, ADELPHI, LONDON, W.C.

ROBERT MACLAREN and CO., EGLINTON FOUNDRY, GLASGOW,
Manufacturers of all sizes of Cast-Iron Main Pipes, by an improved Patent. General Ironfounders, Gas Engineers, and Wrought-Iron Tube Makers.

TO GAS ENGINEERS AND FITTERS.
Every Description of
GAS LANTERNS & REFLECTOR LAMPS
For Shop Windows kept in Stock.
W. DAVIS, 17, Wells Street, Oxford Street, LONDON, W.
Established 1820.

C. & W. WALKERS'
WOOD SIEVES FOR PURIFIERS.
These justly celebrated Sieves, with bevel bars and hard-wood side frames, have been extensively made by Messrs. Walker for over seven years, and their advantages and durability are fully established. Messrs. Walker make them in very large quantities, having mills and machinery specially laid out for them, producing them at the most moderate cost.
MIDLAND IRON-WORKS,
DONNINGTON, NEAR NEWPORT, SHROPSHIRE.
8, FINSBURY CIRCUS, LONDON, E.C.

TO COALOWNERS.—TENDERS FOR GAS COAL.
THE Directors of the Commercial Gas Company will meet on Friday, the 9th day of July next, to receive TENDERS for the supply of 53,000 tons, or a less quantity, of the best GAS COAL.
Particulars can be obtained by letter to the Company's Engineer.
Tenders to be addressed to the Secretary, and endorsed "Tender for Coal," to be delivered at the Company's Office before Ten o'clock on the 9th of July next.
The Directors do not bind themselves to accept the lowest or any tender.
By order of the Directors,
GEORGE JAQUES, Secretary.
Stepney, London, June 12, 1869.

CATHELS'S Patent District Dry Gas- GOVERNOR is the only perfect self-acting contrivance for regulating the pressures in the higher levels of a district.
For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS'S Patent Four-way Disc GAS-VALVE—ONE OF WHICH SERVES AS THREE ORDINARY VALVES—is the best Valve for gas-works.
For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS'S Patent Ribbed Gas Main- PIPES cost but about ½d. to 2d. per yard (depending on the size) more than Plain Pipes, and ensure PERFECT GAS-TIGHT CONNEXIONS with the Service-Pipes.
Apply to Messrs. BEGGS & SON, 37, Southampton Street, Strand, LONDON.

W. J. HOLLANDS,
IRON MERCHANT,
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SOCKET, FLANGE, HOT-WATER PIPES, AND ALL CONNEXIONS; RETORTS, HYDRAULIC MAIN, LAMP-COLUMNS, &c.; AND EVERY DESCRIPTION OF CASTINGS AND WROUGHT-IRON-WORK FOR GAS AND WATER-WORKS, STEAM, AND GENERAL PURPOSES.
N.B.—All goods kept in stock, and supplied at wholesale prices. Estimates given, and orders by post punctually attended to the same day.

JAMES OAKES and CO.,
ALFRETON IRON WORKS, DERBYSHIRE,
AND
WENLOCK IRON WHARF, 20, WHARF ROAD,
CITY ROAD, LONDON,
Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water-Works, including Iron Retorts, Socket and Flange Pipes, Bends, Branches, and Syphons of all sizes, Lamp Columns, &c., &c.
N.B.—Orders for Cast-iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention.
CHARLES HORSLEY, Agent.

JAMES M'KELVIE,
CANNEL COAL MERCHANT,
HAYMARKET,
EDINBURGH.
Established 1840.

FIRE-CLAY GAS-RETORTS, &c., CANNEL AND STEAM COALS.
WILLIAM FRASER, Inverkeithing (owner of the Works at which Fire-clay Retorts were first made), having greatly enlarged his works, can supply retorts and other fire-clay goods to any extent.
References can be given to managers of above a hundred Gas-Works whom he supplies.
WILLIAM FRASER ships COWDENBEATH PARROT COALS at Charlestown and Burntisland at 12s. per ton; and HALBEATH STEAM COALS, on Navy List, at 8s. 6d. per ton.

LINTZ COLLIERY COMPANY.
FIRE-BRICK AND RETORT WORKS.
THE LINTZ COLLIERY COMPANY
Beg most respectfully to draw the attention of
GAS COMPANIES, FURNACE BUILDERS, FIRE-BRICK DEALERS, & OTHERS,
To the superiority of their
FIRE-CLAY GOODS,
Where resistance to heat is of paramount importance, an ample guarantee of which is in the fact of their extensive use by most of the Iron Manufacturers in the North of England.
Not only is the quality of the Fire-Clay inferior to none in the northern Coal-field, but the greatest care is taken in selecting it. It is all hand picked, and well weathered before use.
All orders for
FIRE-CLAY RETORTS of any shape or size, FIRE BRICKS, &c.,
Will meet with prompt attention.
LAYCOCK'S GARESFIELD COKE.
OFFICES: LINTZ COLLIERY, BURNOPFIELD, Co. DURHAM; AND
QUAYSIDE, NEWCASTLE-ON-TYNE.

CANNEL COAL.—The West Yorkshire Iron and Coal Company, Limited, beg to draw the attention of Gas Companies to their Cannel, of which the following is the analysis made by W. Hurgon, Esq., F.C.S.:—

Yield of gas per ton	10,296 cubic feet.
Illuminating power rather over	21 sperm candles.
Yield of coke per ton . . .	12 cwt.

The actual working, as reported by one of the largest gas companies in Yorkshire, gives results still more favourable, viz—

Yield of gas.	10,416 cubic feet.
Illuminating power . . .	21·89 sperm candles.
Coke	The same.

We add from the same source the capabilities of the common gas coal—

Yield of gas.	10,080 cubic feet.
Illuminating power . . .	14·41 sperm candles.
Yield of Coke	13 cwt.

COLLIERIES—WEST ARDSLEY, near LEEDS.

For further particulars, address to the Office of the Company, 15, York Place, LEEDS.

POPE & PEARSON'S GAS COAL. We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles.*

One ton yields 12¼ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, West Riding and Silkstone Collieries, near LEEDS.

OLD WEMYSS CANNEL COAL.—Yield of gas per ton, 12,896 cubic feet; illuminating power, 31·75 standard candles. Port of shipment, Wemyss.

Analysis and price on application to MR. WM. CAREY, Manager, Wemyss Colliery, Kirkcaldy, FIFE.

SWANWICK CANNEL COAL. Illuminating power 23·98 candles; yield large, and coke good.

Analyses by W. Valentin, Esq., of the Royal College of Chemistry, London, and William Fiddes, Esq., F.C.S., Gas-Works, Bristol, with price and terms, forwarded on application to H. BOAM, Head Office, 1, Darwin Terrace, DERBY.

CANNEL COAL.

MESSRS. GRIFFITHS BROTHERS,
COPPA COLLIERY, MOLD,
Beg leave to call the attention of Gas Companies to the superior quality of their Cannel for gas-making purposes.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to GRIFFITHS BROTHERS, Coppa Colliery, Mold, FLINTSHIRE.

THOMAS EDINGTON & SONS,
PHŒNIX IRON-WORKS,
GLASGOW,
Manufacturers of all kinds of
GAS AND WATER PIPES,
Branches, Bends, Water-Traps, Tank-Plates, Valves, and general Castings. Also
RAILWAY CHAIRS & SLEEPERS,
AND
GRIFFIN'S PATENT PERMANENT WAY.
London Office, 63, Old Broad Street.

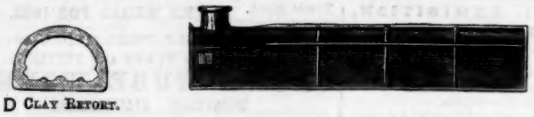
OXIDE OF IRON,
We are prepared to supply, on moderate terms,
HYDRATED PEROXIDE OF IRON (BOG OCHRE),
Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.
FRANCIS RITCHIE & SONS,
BELFAST.

BIRTLEY IRON WORKS,
CHESTER-LE-STREET,
DURHAM.
Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Office in London, Mr. E. M. PERKINS, 101, Cannon Street, E.C.

WALTER MABON & CO.,
Engineers,
ARDWICK IRON-WORKS,
FAIRFIELD STREET, MANCHESTER,
MANUFACTURERS OF
IRON TANKS, GASHOLDERS,
GAS APPARATUS,
PIPES, VALVES, IRON ROOFS,
WROUGHT AND CAST-IRON GIRDER
DESIGNS, SPECIFICATIONS, & ESTIMATES FURNISHED.



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FRASER'S PATENT RIBBED RETORTS.

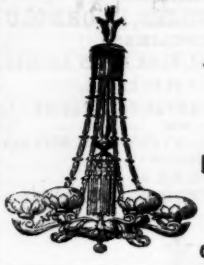
The IRON RIBBED RETORTS are more durable than plain castings, and retain their original shape to the last.

The "Ribs" strengthen the FIRE-CLAY RETORTS, and by affording an increased heating surface favour the more speedy and perfect carbonization of the Coals.

These Retorts are now in use at some of the London works, and in a great number of the provincial gas-works.

For Illustrated Circular, with testimonials, &c., apply to

A. C. FRASER, GAS-WORKS, COLCHESTER.



F. & C. OSLER,
45, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.
ESTABLISHED 1807.
MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,
WALL LIGHTS, & LUSTRES FOR GAS & CANDLES.
TABLE GLASS OF ALL KINDS.
CHANDELIERS IN BRONZE & ORMOLU. MODERATOR LAMPS.

ROBERT DEMPSTER,
Gas Engineer and Contractor, Rose Mount Foundry, Elland, near Halifax.

R. D. recommends his Fire-Brick Retorts to Engineers and Managers of Gas Companies; they last from 10 to 12 years.

Iron and Fire-Clay Retorts.
Annular and Pipe Condensers.
Scrubbers and Purifiers, all sizes.
Steam-Engines and Exhausters.
Hydraulic Centre-Valves.
Station-Meters and Governors.
Photometers & Pressure-Gauges.
Lamp-posts and Brackets.
Cast-Iron Mains and Syphons.
Wrought-Iron Tubes, Water Tanks.
Wrought-Iron & Cast-Iron Roofs.
Gasholders, Single-Lift or Telescopic.
Gas Castings of every description.
Retort Setters and Fitters sent to all parts of the country.
Wood Sieves for Purifiers.

Plans and Specifications prepared.

GEORGE ANDERSON,
GAS AND CONSULTING ENGINEER,
19, NORTHUMBERLAND STREET, STRAND, W.C

MR. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.

PATENTEE and MANUFACTURER of the following Inventions:—
RETORT SETTINGS, heated by tar without the production of smoke.
STEAM-ENGINES and EXHAUSTERS, separately or combined.
FOUR-WAY VALVES, one of which is equal to three ordinary Valves.
STATION GOVERNORS—the Gasholder cannot tilt and cause accident.
BREEZE AND TAR FUEL MACHINE.

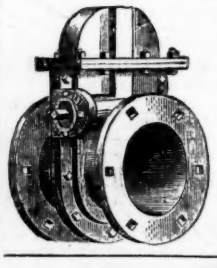
A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d.

N.B.—The second edition of this Work, *now ready*, contains illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.

"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artizan.*

REDUCED PRICES
OF
B. DONKIN & CO.'S
IMPROVED GAS-VALVES
WITH WROUGHT-IRON PINIONS,
From 2 inches to 18 inches, price 9s. 6d. to 12s. per inch diameter.

TRADE MARK.



List of prices, with full dimensions of all sizes up to 36 inches, to be had on application.

These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.

VALVES MADE WITH OUTSIDE RACKS TO ORDER.
ALSO,
SCREW WATER-VALVES WITH GUN-METAL FACES.

B. DONKIN & CO.,
GENERAL ENGINEERS AND IRONFOUNDERS,
MAKERS OF STEAM-ENGINES,
BERMONDSEY, LONDON, S.E.

WALTER FORD,
159, GRAY'S INN ROAD, LONDON.
MANUFACTURER OF WET AND DRY GAS-METERS, STATION-METERS, GOVERNORS, &c. &c.

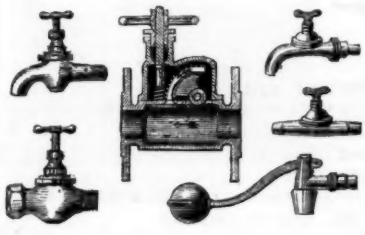
Sole Manufacturer of PADDON'S PATENT STREET-LAMP REGULATORS, for insuring any required consumption. These Regulators are in general and increasing use, and references can be given to Gas Companies who use them for every Lamp.

GEORGE ORME & CO.,

MANUFACTURERS OF

CONSUMERS GAS-METERS, STATION-METERS, GOVERNORS,
PRESSURE & EXHAUST REGISTERS,
PRESSURE-GAUGES, MINUTE-CLOCKS, PHOTOMETERS,
INDICES FOR GAS AND WATER METERS,
INDICATORS,
FITTINGS FOR RAILWAY CARRIAGES AND LAMPS,
AND EVERY DESCRIPTION OF
GAS, STEAM, & WATER FITTINGS,
ON THE MOST APPROVED PRINCIPLE.

WORKS: PARK STREET, OLDHAM.



JOHN WARNER & SONS,

Bell and Brass Founders to Her Majesty,

8, CRESCENT, CRIPPLEGATE, LONDON, E.C.

WARNERS'

PATENT QUADRANT-MOTION SLUICE OR GAS VALVE.

All the advantages of the ordinary sluice-valve are obtained at much less cost, and the liability to set fast and get out of order entirely obviated.

Particulars of the Quadrant Valve, also of Hydraulic Machinery, High or Low Pressure Cocks, Water-Closets, Gas-fitting in all its branches, and general Plumbers Brass-work, can be obtained upon application.

SCHOLL'S

PATENT PLATINUM

GASLIGHT PERFECTER.

Extract from Report by Dr. Letheby:—

"The results have been very remarkable, for they show an average increase of 63 per cent. on the illuminating power of the gas. I am of opinion, therefore, that the invention is of great practical value."

Price 1s. each for Fish-tail Burners.

To be had retail of Gas-Fitters and Ironmongers, and wholesale of

JOHN SCHOLL, 41 & 42, BERWICK STREET, OXFORD STREET
LONDON, W.

Terms on application. N.B.—A specimen sent free on receipt of Twelve stamps.

*** Further testimonials from Drs. Frankland and Crooks, showing the great practical value of this invention, will be shortly published.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gasfittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

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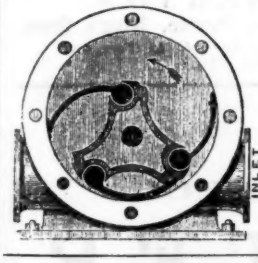

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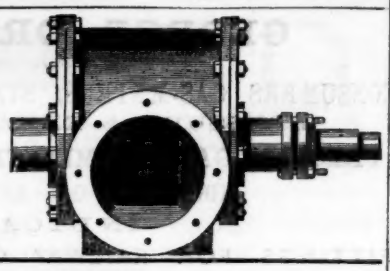

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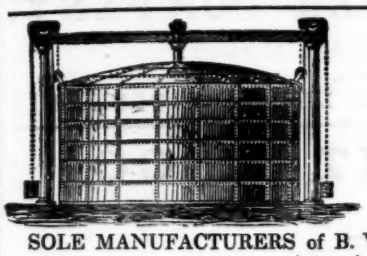

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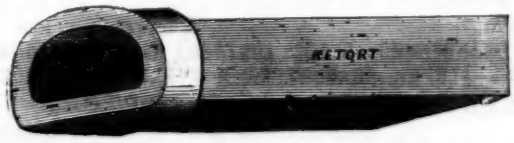

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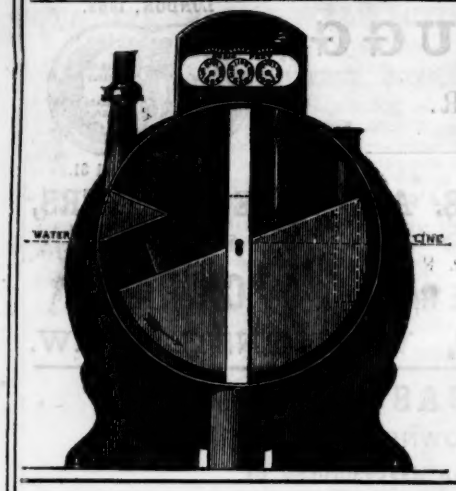

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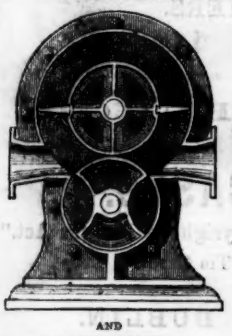

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